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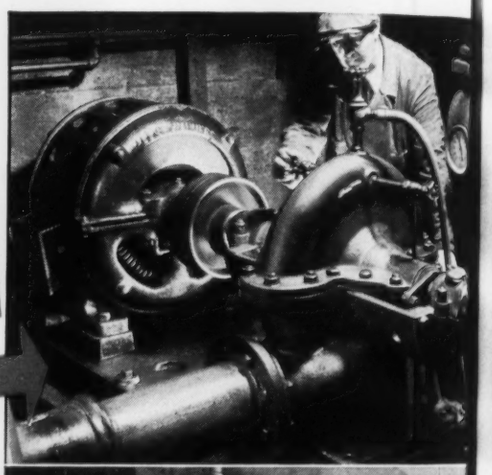

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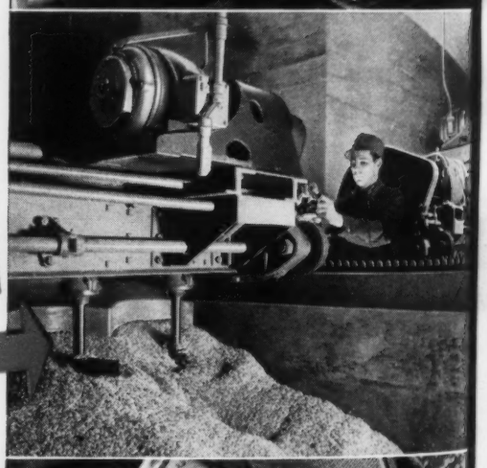

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MACHINE DESIGN

THE PROFESSIONAL JOURNAL OF CHIEF ENGINEERS AND DESIGNERS

Volume 12 — SEPTEMBER 1940 — Number 9

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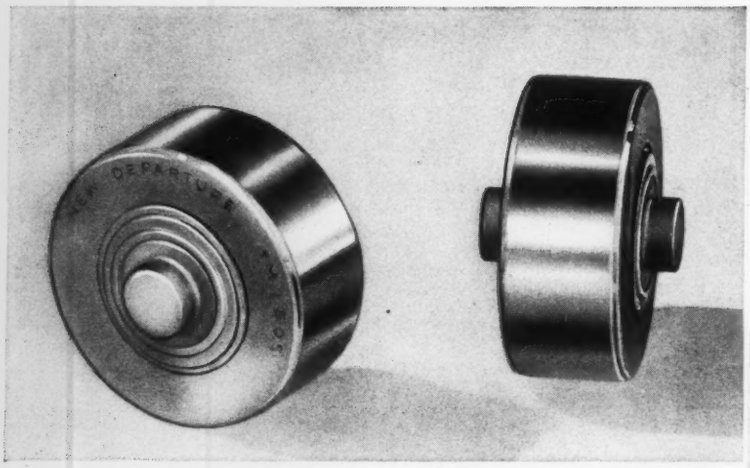
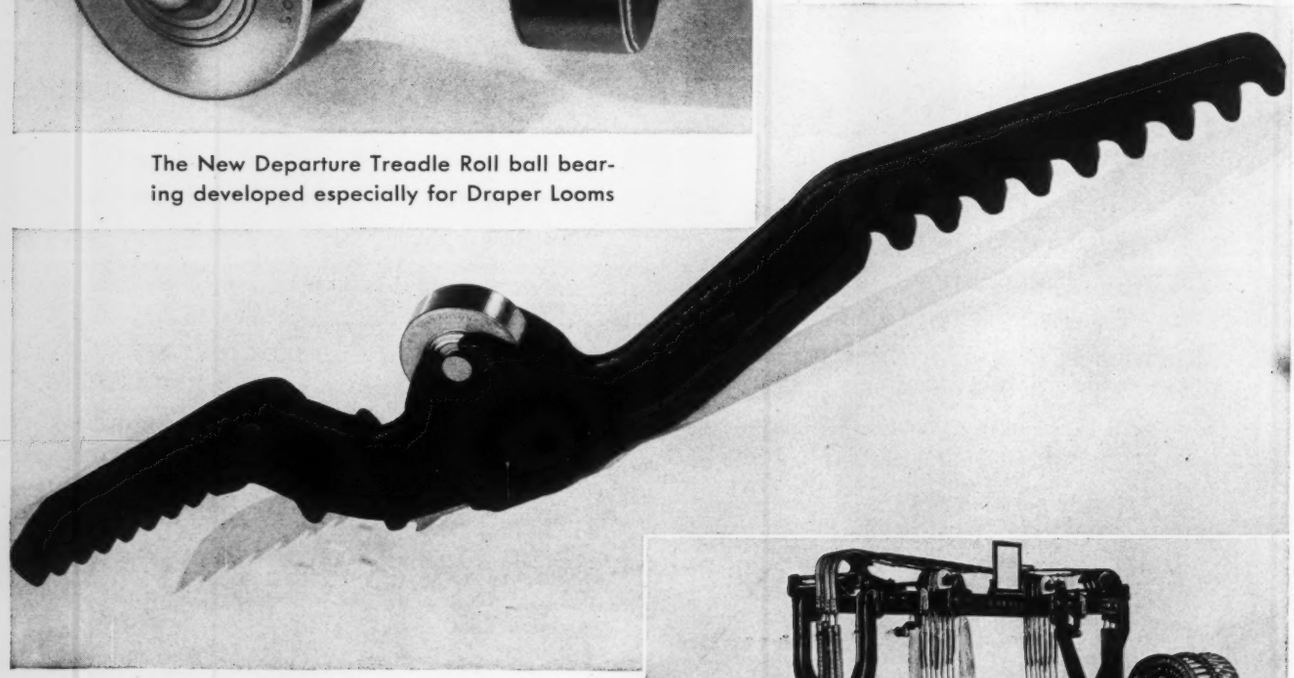
TO REALLY REDUCE LOOM MAINTENANCE



The New Departure Treadle Roll ball bearing developed especially for Draper Looms

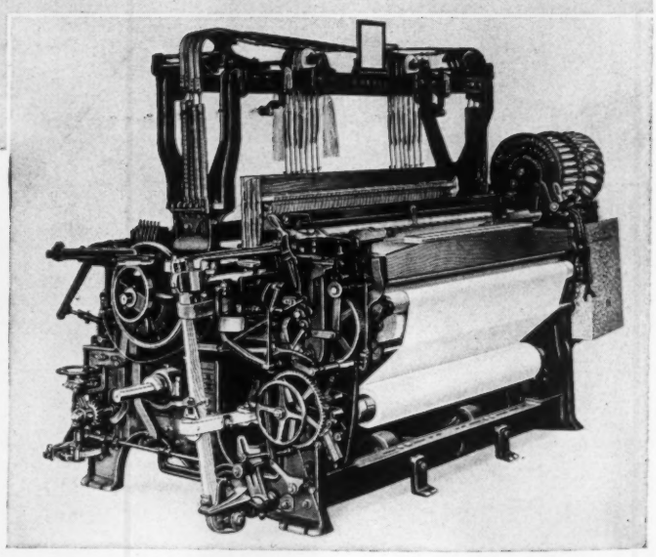


● When modern design results in lower maintenance costs–it means wider profit margins for machine users.

Alert to every possibility for betterment, the DRAPER CORPORATION, by use of New Departure's self-sealed treadle roll bearing, takes a decided step forward in reducing loom operating costs.

Made of high carbon, chrome alloy steel—heavily built to absorb shock—completely protected from dirt or lint—fully lubricated for long life, this "new departure" by New Departure practically eliminates shutdowns for roll replacements. Not only is cam life greatly increased, but this ball bearing is easy rolling, cannot rub at the sides of the treadle arm—and its hard, smoothly finished surfaces do not become clogged with accumulated lint and dirt.

Here is a truly modern improvement that really does pay dividends. New Departure, Bristol, Conn.



DRAPER LOOMS equipped with New Departure treadle roll ball bearings are better prepared than ever for higher speeds.

NEW DEPARTURE

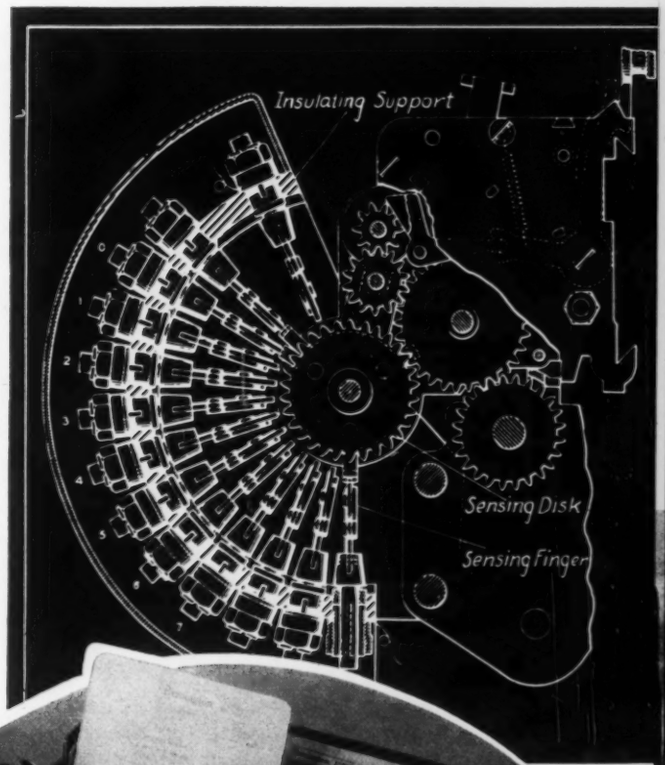
PIONEER OF THE SELF-SEALED BALL BEARING

2903

MACHINE DESIGN

Accounting Machine Obviates Manual Operations

By E. O. Roggenstein
Development Engineer
Remington Rand Inc.



DESPITE the fact electric operation has been used in office machines for more than a decade there is practically no limit to the extent to which it can be further developed. Formerly electricity was utilized mostly for motive power. Now, requirements of speed and accuracy make it vitally important to reduce operator fatigue to the utmost. This is accomplished effectively in the bookkeeping machine illustrated in *Fig.* 2 by reducing the number of manual operations through the use of electricity as a convenient motive power and also to take the place of the human element in performing mental operations.

Most difficult problem in the design of this bookkeeping machine was to develop a method for reproducing "setup" informa-

Fig. 1—Top—Sensing device is brain of machine. Fig. 2—Right—Increased speed and accuracy are obtained in this bookkeeping machine by reproducing "setup" information

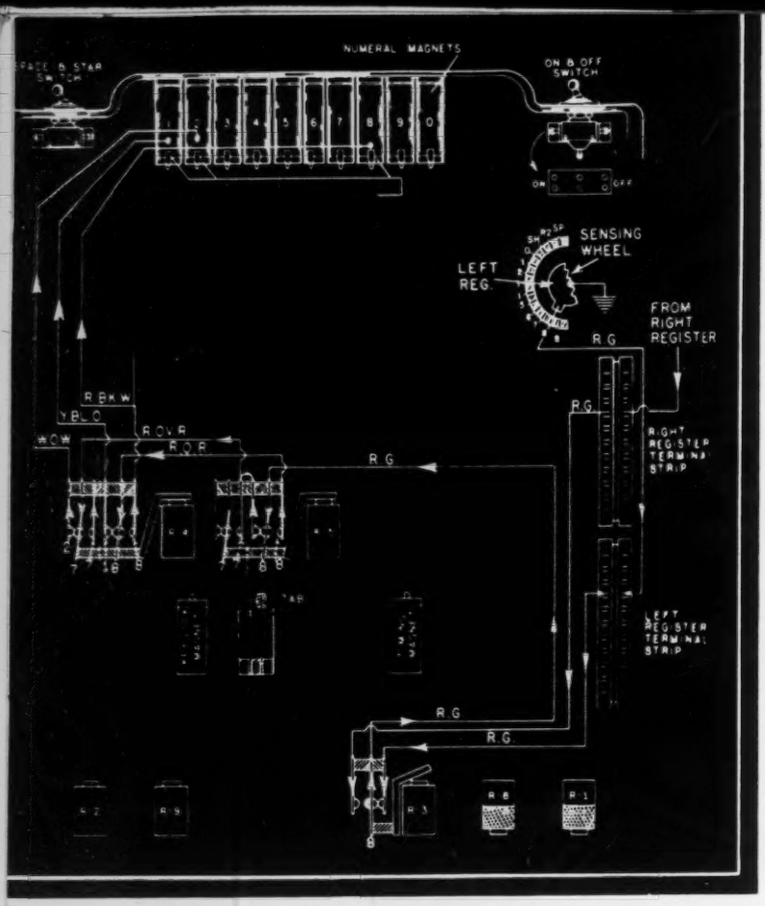


Fig. 3—Diagram of circuit connections shows method used in selecting proper figures for printing

tion automatically which formerly had to be copied by the operator. For instance, in earlier designs if various items were accumulated in registers or accumulators, it was the operator's job to read such information from dials, select the proper digit position and copy this amount manually so that the machine recorded the same on the ledger sheet. This specific operation has been solved by means of electrically sensing the registered amount from accumulators and transmitting this sensed information into the machine so that the corresponding keys are released, these heretofore having to be depressed by the operator.

Selects Positive or Negative

In the new machine it was necessary also to provide means for the proper digit selecting, as well as for determining whether or not the amount registered should be printed as a positive or negative figure. Another vitally important factor was to increase the flexibility of the machine, which from a commercial standpoint is desirable. All of these problems were solved, principally by applying electric solenoids, relays, etc. to the existing design. This resulted in keeping the redesigning of the mechanical parts at a minimum.

A unique method is employed in the sensing device through which information is transmitted from the accumulator wheels to the machine without insulating the wheels from the machine proper. Consequently, otherwise necessary structure and mechanisms are obviated. The operating voltage of the solenoids and relays had to be carefully selected to eliminate the possibility of operating failure caused by dirt and grease. Best results are experienced with a potential of 40 to 48 volts, which at the same time makes possible the use of solenoids and magnets of smaller dimensions. Weight and size of the entire machine are thus reduced; also the steel wheels themselves serve as contacts.

Various operations are eliminated in the all-electric accounting machine and the printing of positive as well as negative balances or sub-balances is an automatic operation eliminating carriage shift, tabulation to the proper digit, printing of the 9's and 10's complement and automatic symbols to designate that the operation has been correctly performed.

Shown in *Fig.* 1 is a cross-sectional view of the accumulator sensing device in which a molded semicircular insulating support for the sensing fingers is clearly depicted. The sensing teeth on the accumulator wheel are part of a steel disk riveted to the wheel and properly hardened to eliminate mechanical wear. Sensing fingers which contact these teeth are also hardened steel with identical heat treatment. Better conducting material, such as beryllium copper would not resist wear, even when heat treated by the best known method.

Design is Simplified

In order to simplify the design of this unit it was necessary to establish a new manner of sensing. This is accomplished by grounding the negative potential of the source and selecting the setup information from the accumulators by means of contacting the sensing teeth directly. However, this is made possible by making and breaking the contact to the accumulator wheels and the sensing fingers in such a way that no current flows during this period. A series of tungsten contacts, properly protected to eliminate excessive arcing is used. Thus it is possible to use two hardened steel members as contactors, thereby simplifying the construction of the mechanism which ordinarily would consist of individual electrical contacts operated from the sensing teeth.

There is also a decided advantage in using this method, since it provides easy accessibility for adjustments, a vital point in manufacturing and servicing. The supporting member of the sensing finger is a one-piece steel forging shaped so that by means of a chuck-like screw and nut it can be moved easily to a desired position and fastened from the outside of the unit by tightening the nut. The proper tension for the electrical contact is obtained by the spring shown and has proved reliable and uniform.

When sensing positive figures, the accumulator wheels contact the previously mentioned sensing fingers and the impulse is directly transmitted over various relays to the corresponding magnet or solenoid, which in turn releases the power cam of the figure to be printed. The sensing of negative figures is also accomplished by the same electrical circuits without especially designing the accumulator for this purpose. In other words negative figures are sensed from the accumulator in an identical manner.

If a negative amount is accumulated it is necessary to print the complementary figures of that amount, although the sensing fingers of the accumulator contact the corresponding sensing teeth of the figures

shown on the dial. The complementary magnet or solenoid of such a figure will be operative and thus the corresponding figure will be printed by the machine. Construction of the accumulator and the sensing device is as simple as possible. It is not necessary to shift gears and slides, etc., mechanically to transmit an amount from the accumulator which is to be printed as a negative or a credit balance.

When entering a column on the ledger sheet in which an automatic balance is to be printed, it is first necessary for the machine to sense whether or not the amount to be copied is to be a positive balance printed in black or a negative printed in red. This is accomplished by the accumulator itself, and if a credit balance is registered, the relay *R*-4 operates a power cam as shown in the schematic circuit diagram, *Fig.* 3. Through the motive power supplied by the electric motor this cam rotates and shifts the entire carriage and ribbon mechanism, thus getting the machine ready to print in oblique type and at the same time to print in red.

Shifting this ribbon mechanism also results in the reversal of the gears, changing them to an add position. Besides operating this power cam, Relay *R*-4 also changes a set of electric contacts so that, for example, the numeral 8 shown in the diagram would be relayed to release the 1 power cam and therefore print a complement of 8. At the same time Relay *R*-5 is in an inoperative position, resulting in the printing of the 9th complement (required as long as the add 1 position has not yet been reached).

Should the entire register be filled with 8's and this amount be printed as a negative balance, 1 (the 9th complement of 8) would have to be printed in every digit with the exception of the last. The printing of the 1 in every digit would increase the numeral shown on the dial by 1, resulting in 9 appearing in all digits but the last. In this add 1 position the 10th complement of 8 would have to be printed, clearing the number wheel in this position to zero, while a carry-over throws all other register wheels to zero.

Requires No Additional Mechanisms

When printing the last digit Relay *R*-5 must be in an operative position, as shown, to effect the 10th complement. This position is determined by a simply constructed sensing plate, located to the right of the sensing fingers. It is made in such a way that the sensing teeth contact this plate for all numerals from 1 to 9 but not for zero. Due to this fact, it can easily be seen that an electric circuit can be maintained between the sensing plate and the accumulator wheels. Thus when the circuit between the sensing plate and the accumulator wheels is interrupted, a slow release relay is de-energized which in turn supplies current to Relay *R*-5, effecting the change in the circuit so that the so-called 10th complement is effective. The 10th complement position in which the add-one is to be effected is either in the last digit position of the register or in the last position in which a significant numeral appears.

Using the above described method results in an inexpensive and simple construction of the so-called accumulators, since as previously mentioned no additional mechanism is required, thereby keeping the redesigning of existing accumulators at a minimum.

The semi-circular insulating plastic shown in *Fig.*

(*Concluded on Page* 96)

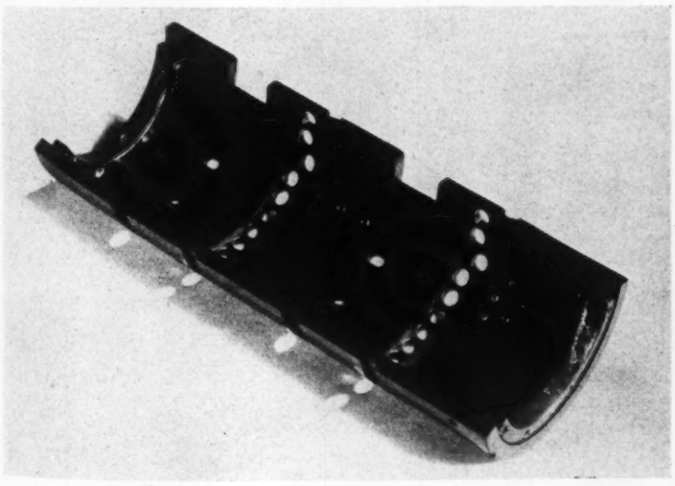


Fig. 4—Molded insulating mounting for sensing fingers

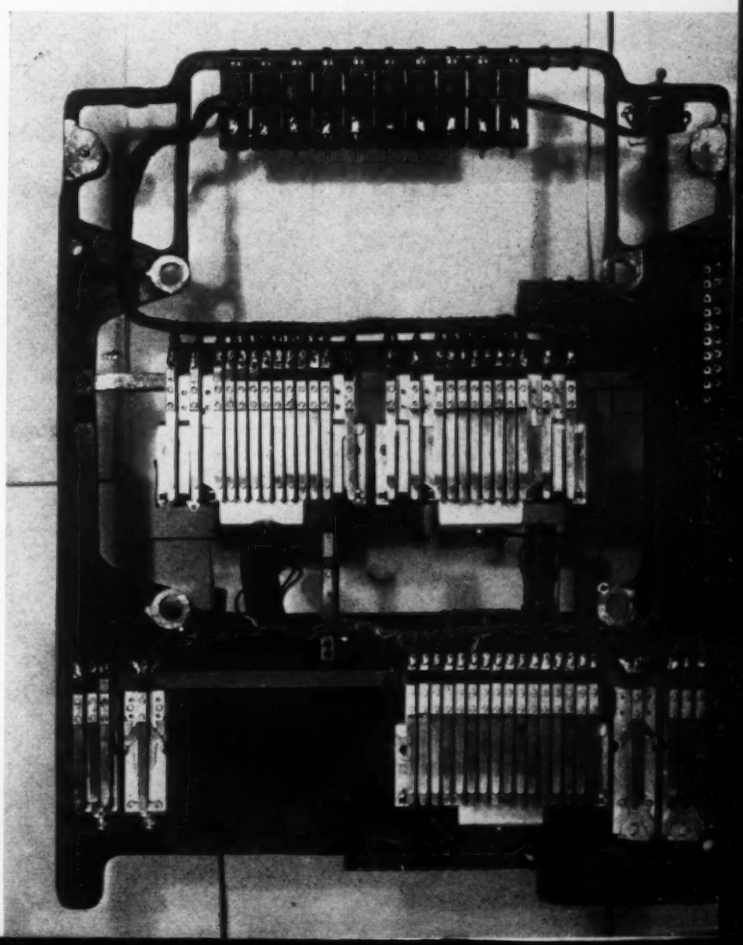
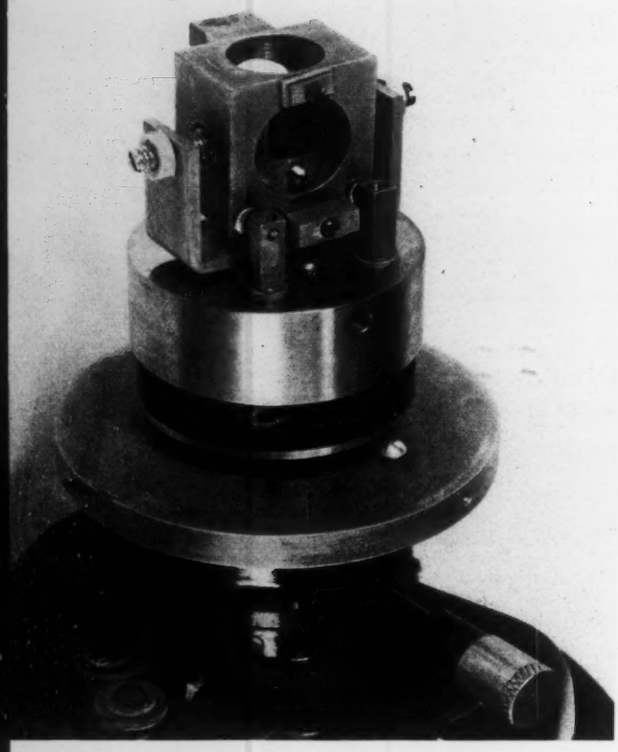


Fig. 5—Aluminum alloy cast base supports relays and solenoids. Cable connections are separable and compactly mounted on terminal panels at right

Scanning the Field For Ideas



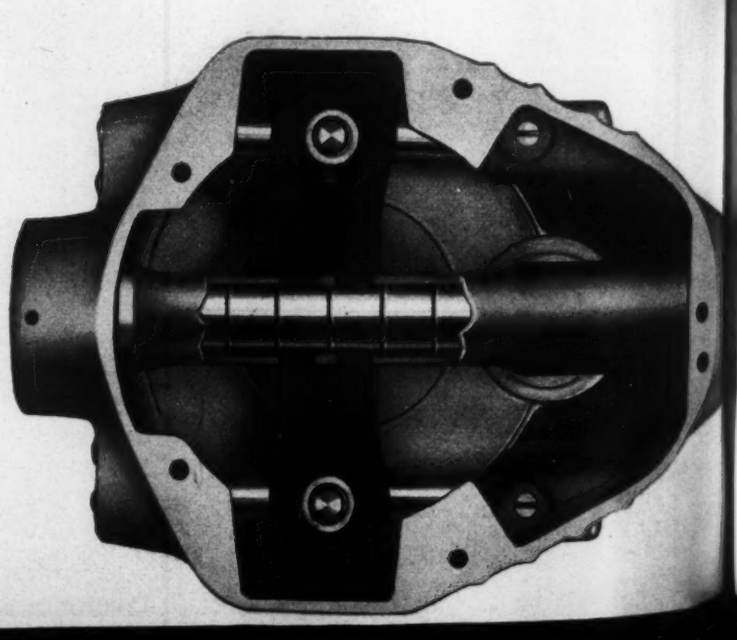
Anticipating speed change before it occurs, a governor developed by Westinghouse Research Laboratories utilizes a gyroscope which is responsive to acceleration rather than velocity like the centrifugal type. Shown attached to a motor shaft it consists of a speed-responsive member, pivoted about an axis through a center of gravity and perpendicular to the axis of the motor, and an acceleration-responsive member in the form of a flywheel mounted on the motor axis.

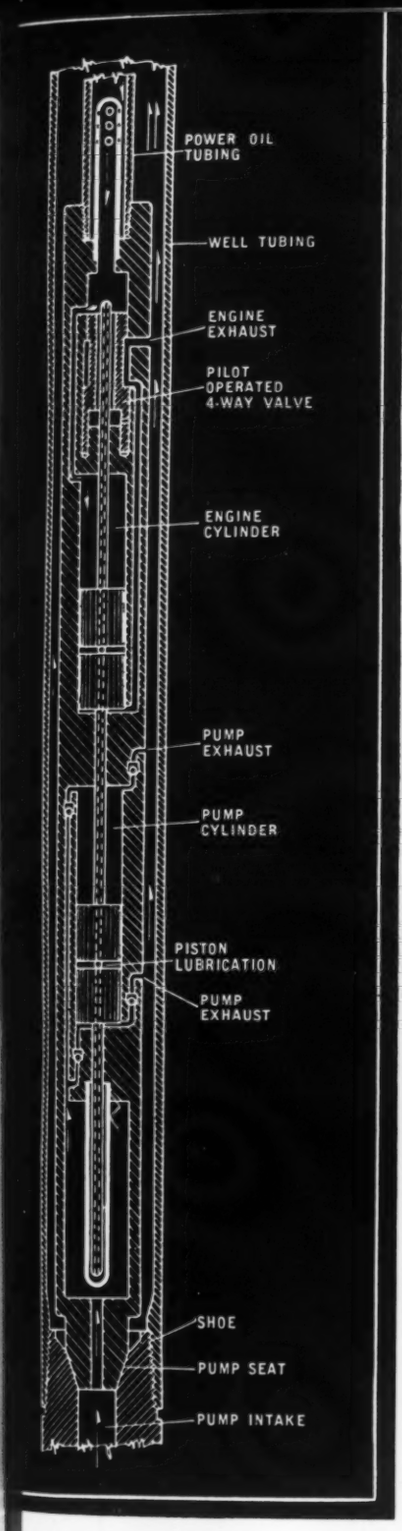
Speed-sensing member is a cage-like structure supporting a pair of weights which give rise to a centrifugal couple tending to rotate the cage about its pivot axis. This rotation is restrained by a Z-shaped flat spring attached to the cage and to a stub shaft coupled to the motor shaft.

Two pairs of silver contacts on the cage and flywheel control a slipring-connected external circuit by relative movement between the cage and the flywheel. In the absence of angular acceleration, the contact forces are equalized by the freedom of the cage and the flywheel to rotate about their pivot axes. During angular acceleration, the torque required to accelerate the flywheel decreases the force between one pair of contacts and increases it between the other pair. This dependence of contact pressure on the cage position and on the flywheel acceleration prevails also at the regulated speed and a hovering condition is established by equality between the centrifugal couple on the cage and the spring torque.

Sling shot acts as a power accumulator and imparts reciprocating drive for a portable hammer designed by the Independent Pneumatic Tool company. In this novel drive the hammer piston is whipped back and forth by the rubber sling with increasing speed on the forward stroke and with shock absorber action on the recoil.

Motor is housed at right angles to the barrel and transmits power through helical gear reduction with crank and Scotch yoke. Reciprocating action is translated in this way to two pins sliding on parallel guide bars. Looped around these pins is the rubber band which passes through the piston to deliver the driving action.

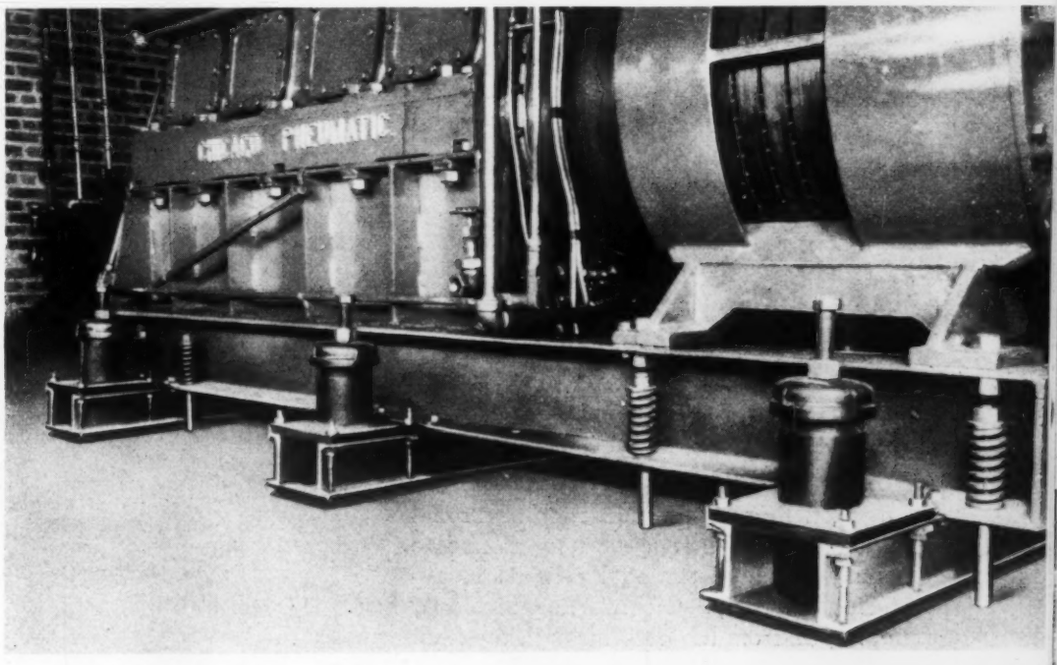




Remote operating hydraulic engine designed by Kobe Inc. for pumping oil wells obviates sucker rods and is useful beyond the effective limit of rods or where they are not warranted.

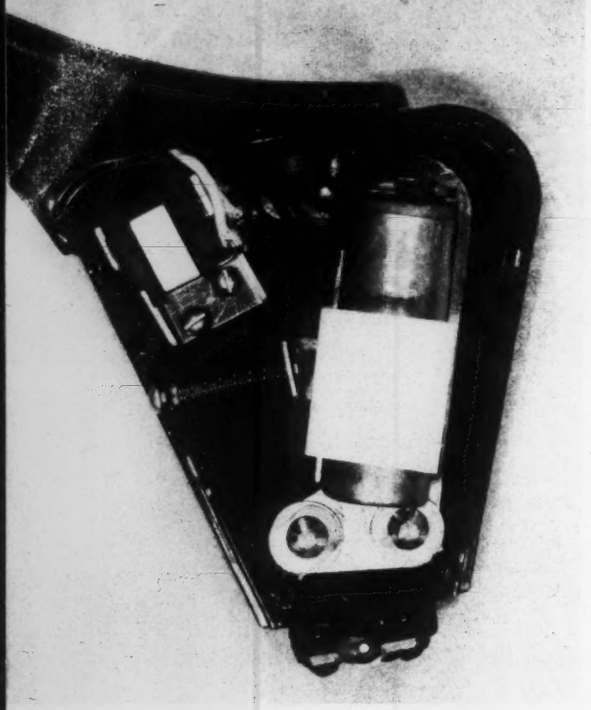
Oil to operate the double acting engine is pumped down the well through small power tubing and is exhausted into an annular space between this tubing and casing. Oil from the well is sucked alternately into the upper and lower end of the pump cylinder through a suction hole in the pumpshoe by the reciprocation of the pump plunger and discharged into the annular space, mixing with the discharged power oil to return to the surface.

Reciprocation of the engine plunger is controlled by a piston type *D* valve which is moved hydraulically by ports on the piston rod. Pump end has a set of ball valves for intake and discharge for each end of the cylinder. Because of the small sizes of pipe used and the necessity for the piston rod to extend completely through the pump for proper hydraulic balance, the space for the valves is greatly restricted. To obtain sufficient area, multiple intake and exhaust valves are employed. Due to the small size of the seats and balls, the high unit pressure, corrosive action of crude oil and abrasive materials, principally sand, the balls and seats are sintered carbide. Balls are solid and seats are small rings brazed to the valve plates in a hydrogen furnace with silver solder.



Vibration control without inertia mass of a concrete foundation has been provided for this 4-cylinder, 4-cycle diesel generator by the use of helical spring absorbers and snubbers. High coil springs provide enough resiliency and thus sufficient deflection to obtain a satisfactory isolation ratio between disturbing frequency of the operating unit and the natural frequency of the elastic support.

Having an integral steel sub-base the set has transverse steel channels with the steel spring isolators welded at each end. To control the secondary free forces of the 4-cylinder engine which otherwise would cause excessive movement of the unit, stabilizers are anchored to bolts in the floor. These recoil springs and stabilizing snubbers are designed by the Korfund company and give steady operation as shown by absence of blur in the 22-second exposure photograph.

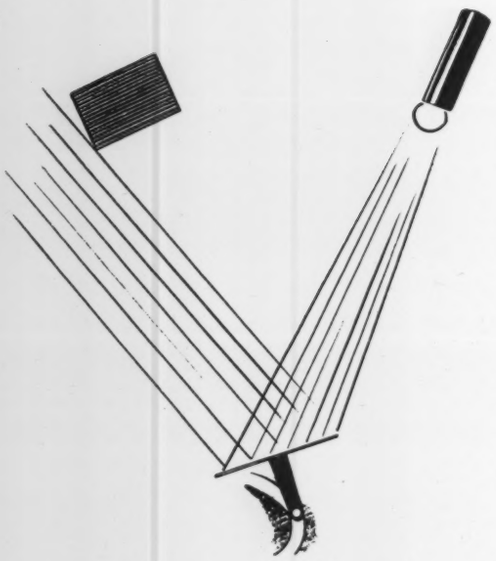


Wig-wag signals from an oscillating mirror directing light to a photoelectric cell reduce the pick-up energy required in phonograph record players and provide a high degree of tone fidelity. Designed by Philco corporation, many interesting features are incorporated in this device to reduce friction and inertia through utilization of "a beam of light".

Vibrations are picked up by a sapphire with which is mounted a paper thin mirror in two rubber bearings. The jewel is floating and adjustable up to one ounce pressure. If excessive pressures should be encountered the jewel retracts and the load is carried by a guard, thus protecting the delicate assembly and also the sound track on the record.

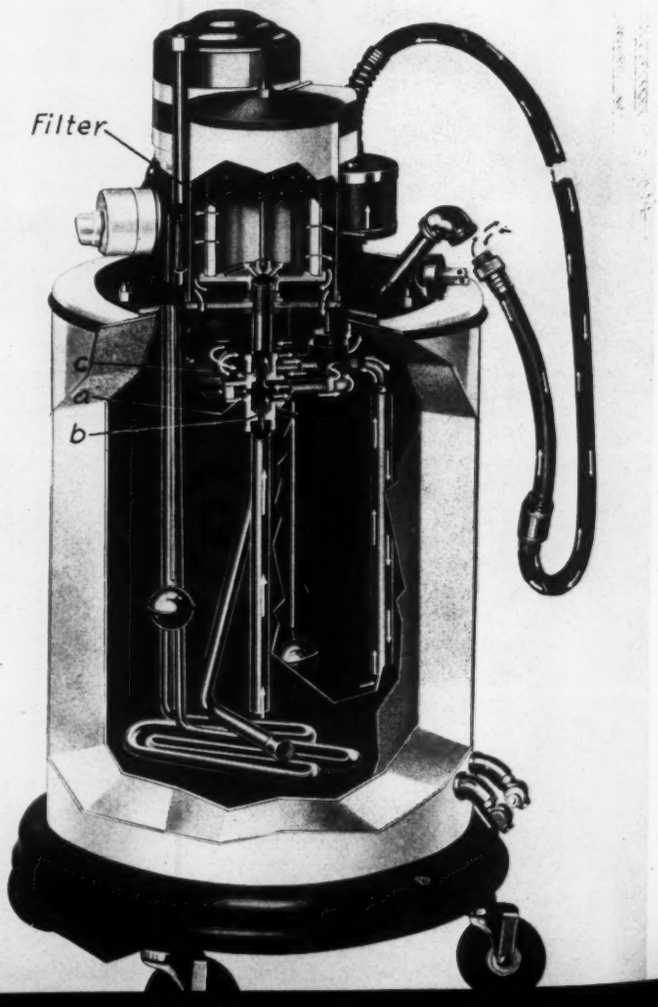
As the floating jewel moves along the record groove, the mirror swings from side to side, flashing the beam of light on and off the photoelectric cell. The flow of current generated by the cell varies in proportion to the amount of light received, causing the loud speaker to reproduce sound from the record.

For better reproduction of high frequencies, mechanical reproduction combines with electrical resonance in such a way as to fortify the signals flashed to the cell. This is achieved by having the arm which supports the floating jewel of phosphor bronze of the exact thickness and length required to make the arm vibrate when a high note is reached. To prevent waver or flicker from the light source and resultant noises in the speaker, a high frequency oscillator is used to convert the supply from 60 to 1,800,000 cycles.



Positive action, protection are assured through the utilization of a relief ball check valve in a gear and crankcase cleaning system designed by Lewis Manufacturing company. Cleaning is effected by pumping oil from the case through the filter and back.

During operation, if anything should go wrong with the action of the filter the relief ball *a* would open at 45 pounds pressure. When the pump is sucking oil from the case, ball *b* seats and ball *c* lifts off its seat so that the oil will pass through the filter. In returning oil to the case by reversing the pump motor, ball *b* rises to let the oil flow out while ball *c* is sucked down tight against its seat so that no oil can get up through the filter. An electric heating unit keeps the oil at 220 degrees and is controlled by a thermostat enclosed in aluminum tube to protect it from acids.



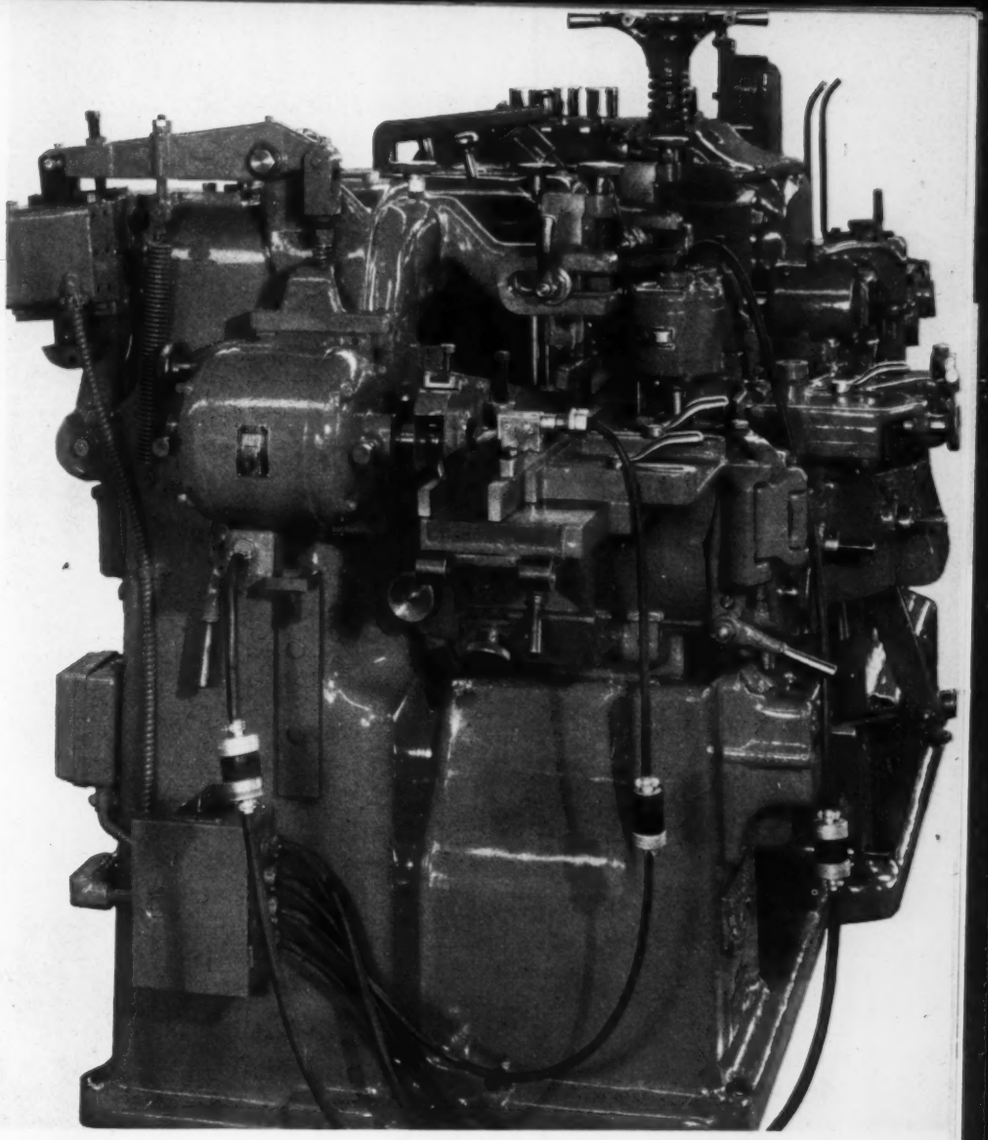
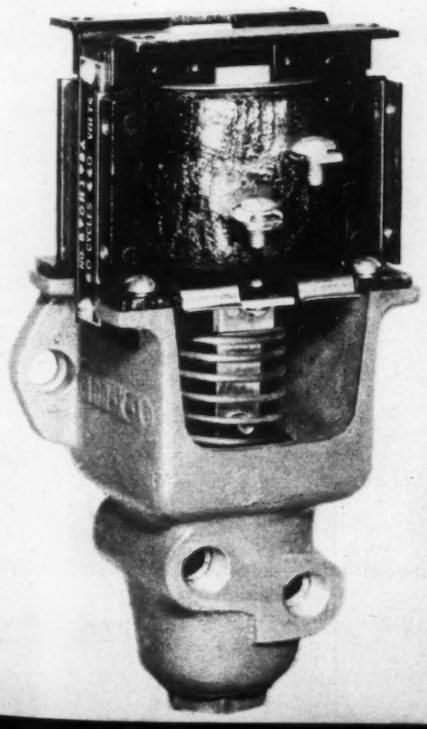


Fig. 1—Moving in and out of a cut in approximately one second, slotting cutter is operated by solenoid in four-side molding machine

Fig. 2—Below—Direct-coupled solenoid operated valve

Solenoids Speed Sequence Control



By D. K. Frost
Electrical Engineer
Mattison Machine Works

PRESENT day mass production is dependent largely on automatic cycling. Whether obtained by all-electric, a combination of electric and hydraulic, or hydraulic means, electric power is employed to obtain sequence control.

Engineers in charge of development formerly tied together individual mechanical elements through systems of gears, cams, link motions and belts to get sequence of operations for various fundamental motions. It became apparent that the desired reduction in time could not be obtained by these means, and the operations remained comparatively complicated. Furthermore, the wear on such devices was excessive under high speed conditions. Later it was found that electrical devices in conjunction with hydraulic movements could link these machine functions with greater speed and accuracy. The elements of wear and time were both solved by

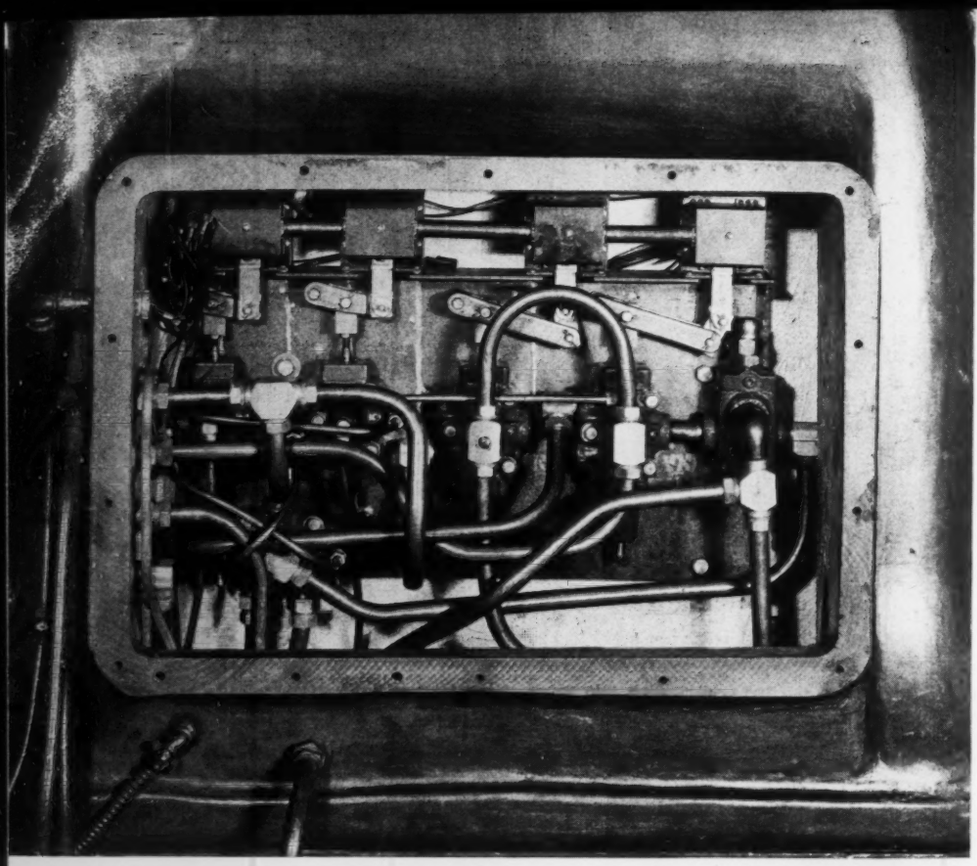


Fig. 3—Four solenoid operated valves are controlled by trip levers and also manually by pushbuttons

Fig. 4—Relation between stroke and pounds pull for solenoids with 85 and 100 per cent applied voltage. Current consumed is also plotted

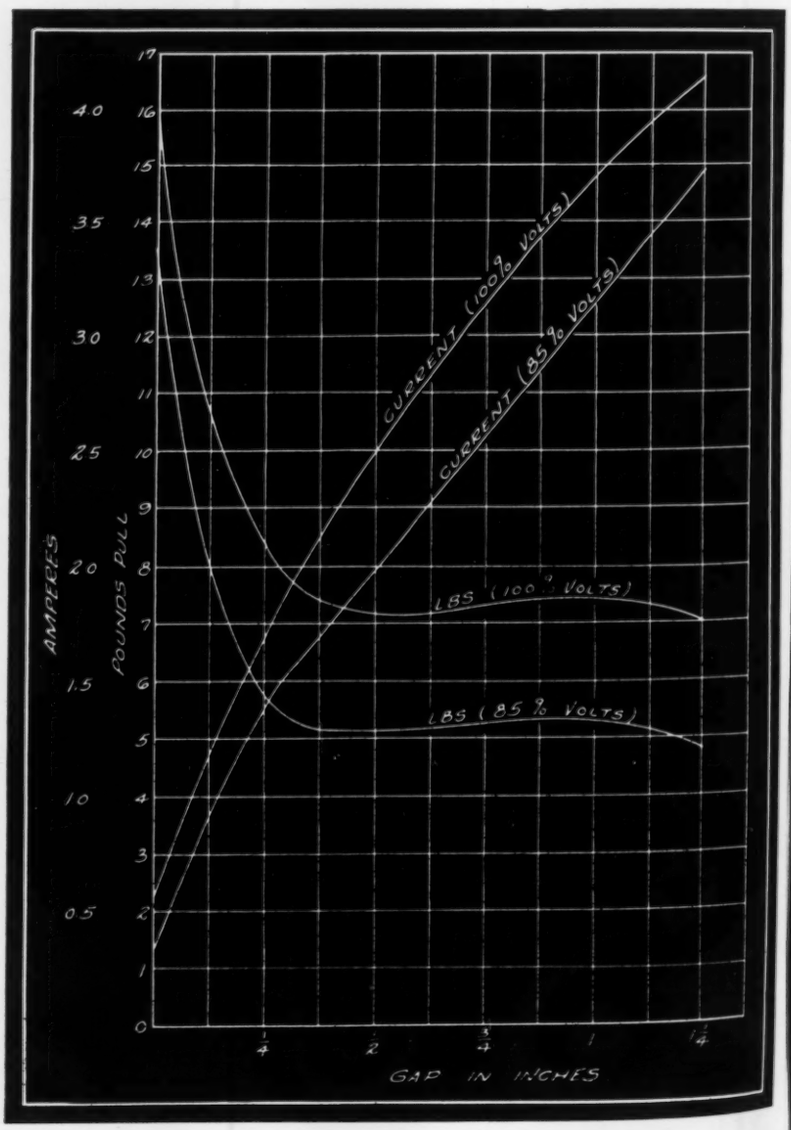
employment to electro-hydraulic operation.

Hydraulic straight line motions are admirably suited both in power and adaptability for many machine operations. Electric power on the other hand basically produces rotary motion and ordinarily is best adapted for such purposes.

The solenoid is one electric device which can fundamentally produce straight line motion. It is, however, limited in power and extent of movement. Amplification of motion can be obtained by a system of levers but at best the solenoid is only suitable for short rectilinear movements. It is, therefore, limited in its applications to the operation of valves, clutches, brakes, locking motions, short indexing or wherever a limited amount of power through a short distance is required but where the operation must be positive and quick.

What might be called a unique application of a solenoid is shown in *Fig.* 1. This solenoid moves a 1-horsepower 3600 revolutions per minute motor weighing about 70 pounds, carrying a slotting cutter on its shaft. The entire assembly moves in and out of a cut approximately 50 to 60 times per minute. A four-side molding machine, it makes screen moldings and is equipped with seven motors in all.

Work is fed through at the rate of 150 feet per minute and the shortest pieces requiring blind slots are somewhat less than 3 feet long. In and out cut is obtained by a microswitch falling into a notch in each piece as it comes along. The impulse current from this switch is relayed to the solenoid. There are variations of these cuts obtained by means



of other limit switches, but the action of the solenoid is the principal point of interest in this discussion.

This solenoid has a pull of 22 pounds at the full 2-inch stroke at 85 per cent volts and 30 pounds at full voltage. Utilizing 50 per cent of the stroke or 1 inch the pull at this gap is perhaps a few pounds higher but the current and consequently the heating is much reduced. As many as 50 to 60 operations a minute are thus obtained on continuous service. Temperature rise does not exceed 55 degrees Centigrade above room temperature, so the insulation is not stressed beyond its safe operating values. Machines of this nature have been in operation over a period of years with only minor replacements.

In applying solenoids the pull of the plunger should be in a straight line or, in other words, the plunger should be accurately lined up with the mechanical linkage to prevent binding against the guides. For instance, several years ago it was necessary to abandon the use of a line of air valves because of continual trouble from sticking and consequent burning-out of the solenoid coils.

Manufacturers of solenoids are now giving the question of proper guiding of the plunger the additional attention it deserves. Hardened steel, stainless steel, brass and new phenolic products with good wearing and low friction qualities have been used successfully. *Fig.* 2 shows a solenoid with dependable plunger action direct coupled to a Sundstrand valve.

In *Fig.* 3, four solenoid-operated valves are shown. These valves are operated automatically by the trip levers shown in the lower right-hand corner of view *Fig.* 5. Also shown in this view are the pushbuttons grouped conveniently for the operator by which the valves may be hand controlled.

Illustrated in *Fig.* 5 is a wide belt sheet grinding and polishing machine. The roll supporting the sheet raises it into grinding position at each end of the stroke. Controlled air pressure brings the sheet being ground into sensitive contact with the belt. A load ammeter indicates the amount of grinding load. Through it and the controlled air pressure, the most efficient working point can be determined and maintained by adjusting the pressure on the support roll

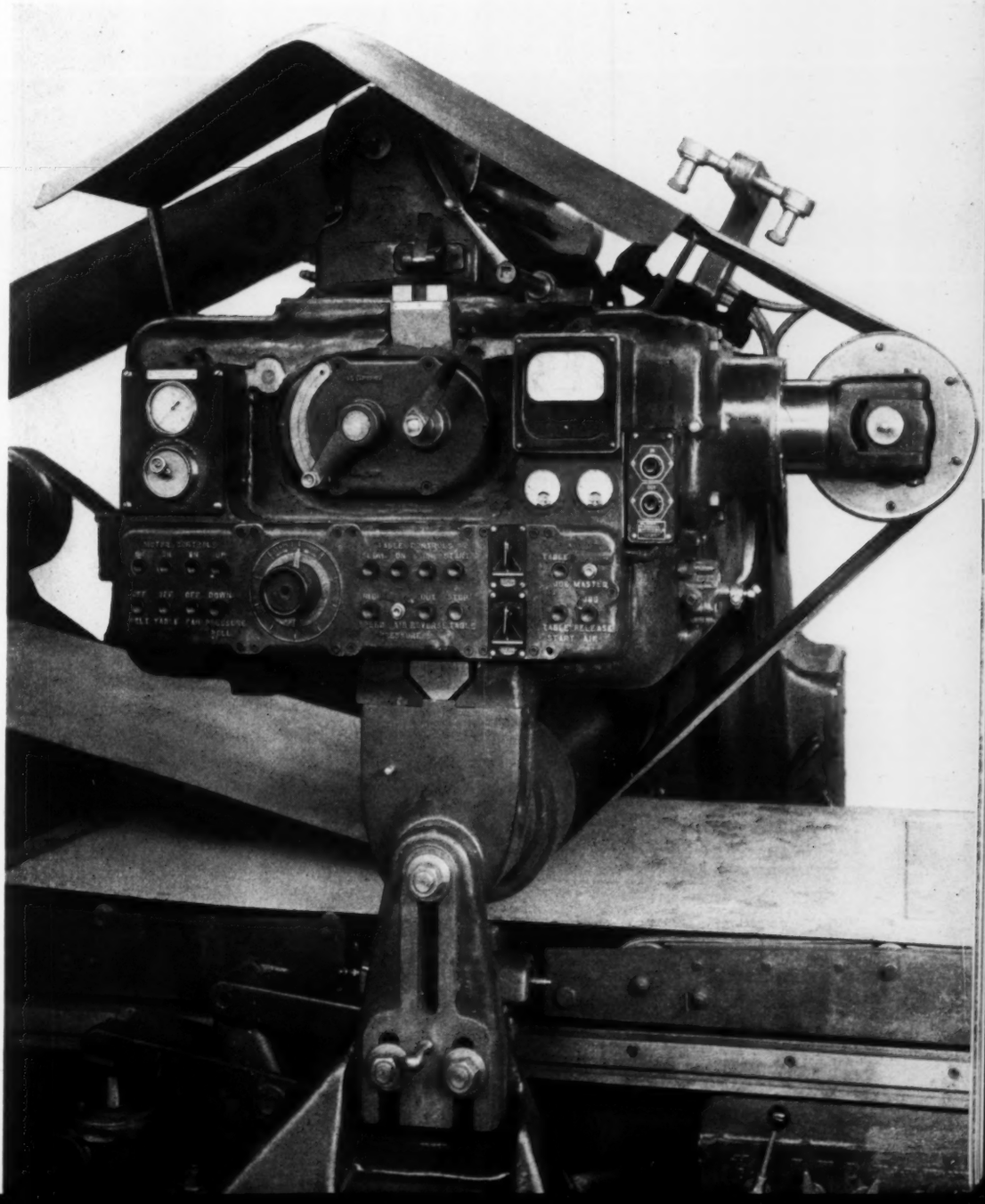


Fig. 5—Table control and abrasive belt are solenoid controlled on belt grinder and polisher

until the proper power consumption has been reached. Although the table movements are entirely automatic, the operator still has complete hand control over the table movements through the center group of push-buttons. This table control is by means of the solenoid-operated valves illustrated in *Fig.* 3.

Abrasive belt is also automatically controlled and oscillated on the rolls by means of solenoid-operated air valves and air cylinder actuating the top idler roll. The travel of the edge of the belt is controlled by two phototubes and light sources shown in the upper right-hand corner above the belt. These not only keep the belt oscillating but also keep it in alignment on the rolls.

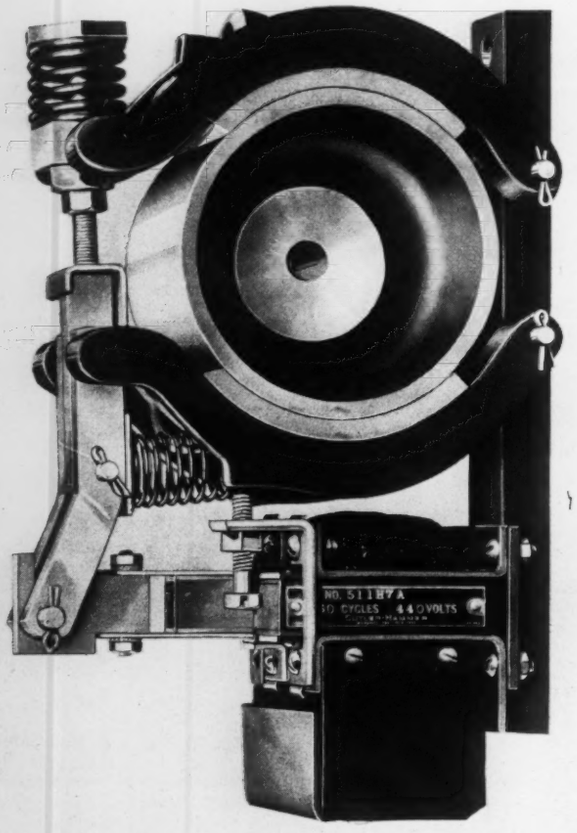


Fig. 6—Solenoid-operated spring-controlled brake

In applying solenoids it is most essential to select a solenoid having specifications which meet the actual load conditions from the beginning to the completion of the stroke.

In *Fig.* 4 is shown a typical curve plotted between the gap or stroke in inches and the pounds pull. The current values are also plotted between stroke in inches and the current at both 100 per cent and 85 per cent volts.

Manufacturers always rate solenoids at 85 per cent and full voltage and recommend selecting the pull values based on 85 per cent voltage. Actually the pull of a solenoid varies directly as the square of the voltage. This provides a factor of safety in guarding against the possibility of low voltage. Therefore, a solenoid should never be selected on the 100 per cent full voltage pull basis. Applying the solenoid at 85 per cent voltage ties in with the next important point, namely, that solenoids must always complete their stroke and seal closed. Solenoid failures in the past have undoubtedly been due in many cases to the fact that something prevented the armature or plunger from fully sealing when pulled closed.

It cannot be stressed too greatly that provision must be made for the plunger to complete its full stroke. It will be noticed that the current rises abruptly from sealed position to 1-4 inch gap.

Force exerted by the magnet increases as the length of the stroke is decreased and at the same time the current inrush and consequently the heating is reduced. Mattison Machine Works has cut the stroke of solenoid values from the rated 1¼-inch stroke down to about ⅜-inch with worthwhile results. The higher the frequency of operation, the smaller is the length of stroke which is practicable.

Reducing Stroke Increases Operations

At 1¼-inch full stroke of this particular solenoid, the initial pull at 85 per cent volts was 10.3 pounds and at full voltage, 14 pounds. Current inrush at 220 volts was 8.95 amperes at 1¼-inch stroke, but at ⅜-inch stroke was only 3.2 amperes while the actual initial pull was still 10 pounds. The sealed pull is about 22 pounds. On account of the reduced current it became possible to operate the solenoid direct from a small limit switch capable of handling only 5 amperes at 220 volts. Expense, also the time element and complication of using a relay to operate the solenoid were reduced.

In operating the solenoid direct, about one-tenth of a second is saved but that one-tenth is highly important. Moreover, at times the solenoid might be called upon to operate thirty to forty times a minute and with the lower current the heating of the coil is no longer a factor where it had been a serious factor before reducing the stroke.

As a general rule the number of operations per minute on a continuously rated solenoid can be increased 400 to 500 per cent by reducing the stroke from 100 per cent to 50 per cent. The time on and the number of strokes are two variables, and the range is so wide that each case should be studied independently where rapid operations are necessary.

Authorities differ as to how much of the available power of a solenoid should be used but, in general, at least two-thirds should be utilized. Where all the work is performed at the beginning of the stroke the solenoid must of course be designed to meet the required pounds pull. The large amount of excess power at the end of the stroke will result in a severe hammer blow. This hammer blow should be absorbed, not only to prevent destructive hammering but also to avoid the heat generated thereby. Air or oil dash pots can be used to absorb

(*Concluded on Page* 92)

Well-Planned Patent Claims Insure Protection

By George V. Woodling

ENGINEERS often overlook the processes involved in obtaining a patent once the invention is turned over to the patent department or a patent attorney. This lack of attention is detrimental to good protection. If the patent department is extraordinarily resourceful and persistent, a satisfactory patent may evolve without any assistance from the inventor or others, but one should not overlook the fact that an attorney cannot be expected to work with more material than is presented him. If he lacks the continual cooperation of the inventor, an unreliable patent may be the result.

Inasmuch as the inventive idea resides most completely in the mind of the engineer-inventor, the writer advocates the extension of this co-operation to the point where the engineer actually assists in drafting patent claims. Many instances reveal that where this mutual assistance prevails, the skill of the engineer in drafting patent claims often equals that of the patent attorney. To help the engineer and the designer in the protection of their creations and in the drafting of patent claims along with the patent attorney, the following article is written.

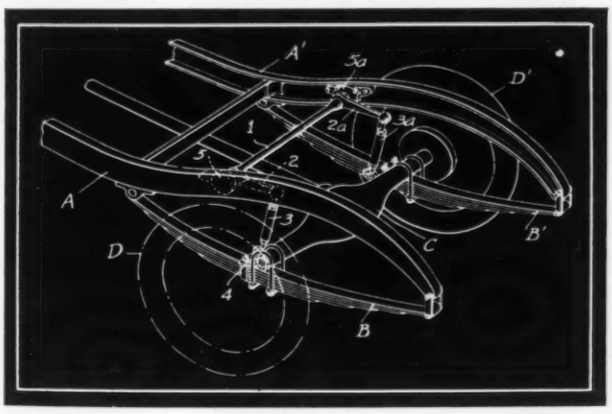


Fig. 1—Torque bar stabilizer. Claim should express relations of parts

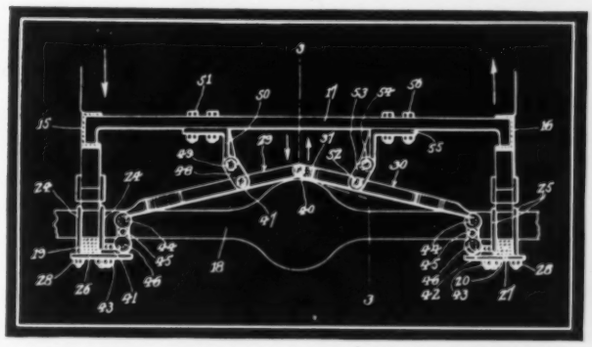


Fig. 2—Opposing lever type stabilizer. Omission of torquebar allows patentability

A *wheel* may be defined as follows: "A wheel is a circular body, capable of turning on a central axis." The words "circular body," when taken alone, may read on* or cover many objects or species besides a wheel. Thus, circular body may cover a circular picture frame, a dinner plate, or a hoop. By reason of the fact that the words, circular body, cover or read on a class of objects made up of two or more species, one speaks of such words as the genus of the definition. By adding to the genus the qualifying words "capable of turning on a central axis" all the species except the wheel are excluded. Accordingly, the qualifying words form the difference which characterizes the wheel from the other species. In other words, a definition is evolved by adding the *difference* to the *genus*.

Claim Is Definition of Invention

In the drafting of patent claims, the same general rule as that explained in the foregoing paragraph is employed. Thus, following claim for an ordinary knife may be drafted by adding the difference to the genus.

I claim as my invention:

1. A knife comprising a handle and a relatively thin cutting blade having one of its ends connected to the handle.

In this claim the word knife is the genus, and the qualifying words "a handle and a relatively thin cutting blade having one of its ends connected to the handle," is the difference. This difference excludes other cutting instruments such as a hatchet or an ax.

In patent claims the genus or the general class of the invention generally is referred to as the "introductory clause," and the difference as the "body" of the claim or the claim proper. The body of the

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*The term "read on" is an expression used a great deal in patent language. A definition "reads on" a device if the device contains elements which satisfy the definition.

claim is called the claim proper because the subject matter of a claim is determined primarily by considering only the elements of the body of the claim and not by reference to the introductory clause. This may be explained by using Claim 1 for the knife as an example. The mere fact that the introductory clause recites "a knife," does not necessarily restrict the claim so that it excludes a hatchet or an ax. The restriction results from the difference set forth in the body of the claim. Hence, in determining the scope of a claim, the introductory clause may ordinarily be disregarded. Instances arise, however, in which the nature of the invention is such that the introductory clause modifies or gives life and vitality to every element recited thereafter in the body of the claim. In these cases the introductory clause is important. Note the following language taken from a court decision:

> ". . . . While it is true that this introductory clause of itself does not describe an element in the combination, it should not for that reason be ignored. Each of the elements of the combination should be read in the light of this clause and should be modified by it. Such a clause by itself may entirely fail to supply a necessary element in a combination . . . . yet it may so affect the enumerated elements as to give life and meaning and vitality to them, as they appear in the combination. . . ."

Each Claim Patentably Different

In drafting patent claims for an application, care must be exercised to make certain that each claim is patentably different from each of the others. This difference is obtained by varying the qualifying words of the body of the claims. A new and more restricted claim, for instance, could be obtained by adding the qualifying word "integrally" before "connected" in Claim 1. This addition gives rise to Claim 2 and would read:

> 2. A knife comprising a handle and a relatively thin cutting blade having one of its ends *integrally* connected to the handle.

Features of patent claims may be further explained by reference to the accompanying illustrations. In writing a claim for the vehicle sidesway stabilizer in *Fig.* 1, which is mounted between the body and axle of the vehicle to prevent sidesway movements but to permit free vertical movements between the sprung and unsprung masses, one may begin by listing the essential or co-operatively associated parts which are to be set forth in the body of the claim. The listed parts, for example, may include: A torque bar, identfied by the number 1; two side bearings, 5 and 5a; two side arms, 2 and 2a; two connecting links, 3 and 3a. Suppose the four groups of parts are cataloged in a claim like the following (this claim and others being numbered consecutively for order rather than relation):

> 3. A sidesway stabilizer comprising a torque bar, two side bearings, two side arms, and two connecting links.

This claim is bad on the ground that it is a mere cataloging of the group of parts for the sidesway stabilizer. The patent office would reject such a claim as an aggregation of parts, on the ground that there is no expressed co-operation between the cataloged parts. Insofar as this claim is concerned, the several parts may not have even reached the point of being assembled. It is important to remember that a claim must set forth a true combination and an operative structure, as opposed to a mere aggregation. The objection as to aggregation may be removed by setting forth the parts as before,

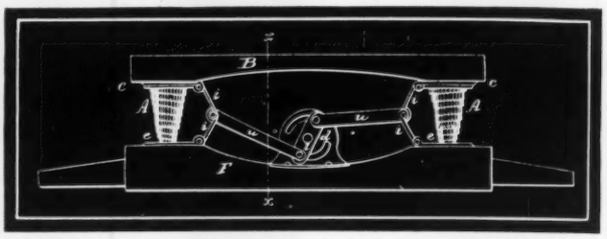


Fig. 3—Opposing hinge type stabilizer. New combination of parts produces same result

and in addition explaining how the several parts co-operate with respect to each other to make a complete operative device. The improved claim may read as follows (words of explanation are in italics):

> 4. A sidesway stabilizer for a vehicle having a sprung and unsprung mass comprising a torque bar *mounted transversely of the sprung mass,* two side bearings *for connecting the ends of the torque bar to opposite sides of the sprung mass,* two side arms *each connected to opposite ends of the torque* bar, and two connecting links *each connecting a side arm to opposite sides of the sprung mass.*

In actual patent prosecution it is not uncommon to have claims rejected as being drawn to an aggregation, even though in fact the device itself is a real combination. The test often resides in the way the claim is drafted. The body of the claim may be prefaced by the phrase "in combination" as illustrated in the sidesway stabilizer claims in the foregoing. Although the phrase is used to convey the idea that it modifies every element recited thereafter in the body of the claim, yet it must not be inferred that the mere use of the phrase will make a combination out of a claim which is otherwise an aggregation.

Words Are Chosen Carefully

With reference to the sidesway stabilizer claims that begin with the phrase. "A sidesway stabilizer comprising . . . ." The word "comprising" is widely used in this capacity. Instead of comprising, words of similar import, such as having, including or consisting of may be used. Care must be exercised in using these words interchangeably. To illustrate, a wheel may *have* or *include* a hub, but it cannot properly be said that a wheel *consists of* a hub. The

words "consists of " are all-inclusive, for when one states that an object consists of something, he must name all the parts of which the object consists. The word "comprising" is not necessarily all-inclusive, but appears to be a more commanding word than "having" or "including."

The sidesway stabilizer Claim 4 sets forth four groups of elements and thus gives a detailed word picture of the device. Such a claim may easily be "designed around" to avoid infringement. Unless the alleged infringing device contains all of the four groups of elements there would be no infringement. The omission of at least one of the recited elements in the alleged infringing device would avoid the charge of infringement, unless an equivalent were substituted for the omitted part. Thus, each of the sidesway stabilizers in *Figs.* 2, 3 and 4 avoids infringement of Claim 4, because each of the devices omits, for example, the torque bar, as called for in the claim.

Have Minimum Number of Elements

This observation may be stated in the form of a proposition, as follows: The larger the number of elements recited in a single claim, the greater is the opportunity for a competitor to omit one of them in his design and thus avoid infringement arising out of the competitor's manufacture, sale, or use.

Therefore, it is a good practice when drafting or checking the claims of an application before the patent is granted to see whether the claims may be designed around by omitting at least one of the recited parts. If one can design around his own claims, it is likely that his competitor can do likewise. The cure for this defect is to draft a broader claim with a fewer number of recited elements. As a specific example, a broader claim for the sidesway stabilizer may be written by combining one or more of the recited elements of Claim 4 and by characterizing each of the groups of elements under an all-embracing term or expression.

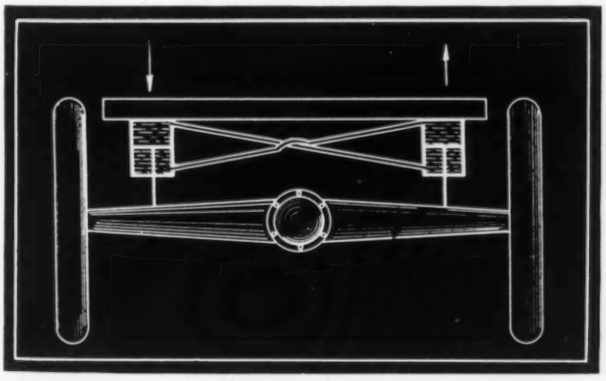


Fig. 4—Opposing fluid type stabilizer. Introduction of hydraulics sets up basis for new set of claims

In combining or regrouping the many parts of a device under a few all-embracing terms, the best results may be obtained by reflecting upon the *function* of the device rather than upon its *structure*. Sometimes one cannot properly visualize the function when his eyes are fixed too strongly on the structure. After finding the function, as embodied in the structure, the next step is to reduce the functions to the indispensable ones and use these as a basis for the claim. A competitor then will find it difficult to design around the claims, because he will have to design his machine so as to omit an indipensable function. In the sidesway stabilizer of *Fig.* 1, the functions as embodied in the structure may be reduced to three indispensable ones; namely, (1) The function of transmitting means for transmitting force from one side of the vehicle to the other to constrain the sprung mass substantially parallel with the unsprung mass; (2) the function of connecting means for connecting the transmitting means to the sprung mass; and (3) the function of connecting means for connecting the transmitting means to the unsprung mass. These three functions give an operative sidesway stabilizer for a vehicle. Having reduced the functions to three, one now may incorporate them into a broad claim which reads:

> 5. A sidesway stabilizer for a vehicle having a sprung mass and an unsprung mass comprising, in combination, (1) transmitting means for transmitting force from one side of the vehicle to the other to constrain the sprung mass substantially parallel with the unsprung mass, (2) connecting means for connecting the transmitting means to the sprung mass, and (3) connecting means for connecting the transmitting means to the unsprung mass.

In the foregoing claim the numbers have been inserted merely to identify the three recited parts, and should not be used in actual practice.

Claim 5 is a broad claim and reads on the sidesway stabilizers in *Figs.* 2, 3 and 4, as well as *Fig.* 1, because there can be found in all the four devices the three features recited in Claim 5. In other words, the designs of *Figs.* 2, 3 and 4 do not avoid infringement of the broad Claim 5.

Qualifying Words Narrow Claim

The claim may be narrowed in scope by changing or qualifying any one, or all, of the three recited features. As an example, feature (1) may be changed without changing features (2) and (3). The qualifying words "opposing lever arm" may be inserted before the words "transmitting means," and a new Claim 6 would read:

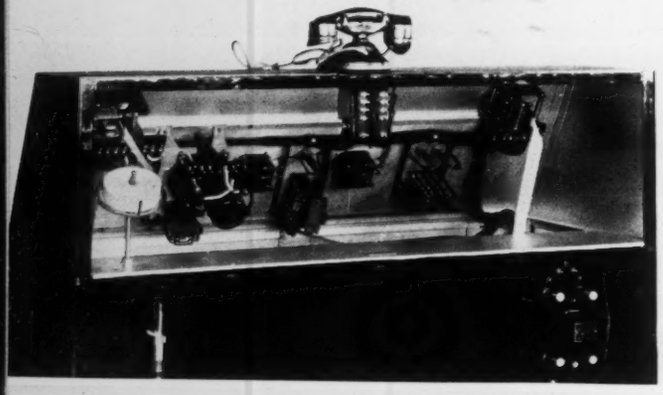
> 6. A sidesway stabilizer for a vehicle having a sprung mass and an unsprung mass comprising, in combination, *opposing lever arm* transmitting means for transmitting force from one side of the vehicle to the other to constrain the sprung mass substantially parallel with the unsprung mass, connecting means for connecting the *opposing lever arm*

(*Concluded on Page* 92)

Dependability First!

INDEPENDENT operation is required in many systems such as fire alarm equipment because service is frequently most needed during interruption of normal power supply incident to floods, lightning, storms and similar happenings. Storage batteries are still considered most dependable for this service as evidenced in the fire alarm control cabinet shown, developed by the Gamewell company.

To eliminate attention required in cycle charging the batteries, direct current is supplied by a copper oxide rectifier with the battery floated across the line. Rectifier is capable of recharging in one-tenth of the discharge time. This particular proportion was selected because it seemed the best balance between rectifier cost and performance. Charging circuit is arranged so that high charge becomes effective by a relay shunting a resistor each time an alarm is transmitted. This charge continues until battery is 95 per cent charged, at which time the rate is automatically reduced.



A marker mechanism punctures holes in a paper tape corresponding to the alarm signalling impulses. This tape feeds continuously from the first impulse until a definite time after the last impulse. Marker mechanism, tape feed and takeup are motor driven as contrasted with clockspring drive used previously. A constant speed shunt motor is used for the marker mechanism and a series motor for the takeup; speed characteristic of the series type serves to maintain tension on the tape.

Motor-driven marker mechanism is provided to serve also as a definite time relay performing switching operations incident to alarm reception. Original design provided for a single motor drive but a more satisfactory and less costly design was secured with separate motors.

All three mechanisms are driven by small 48-volt direct-current motors powered from the storage battery. Armatures and high speed shafts run in sealed-lubrication ball bearings, slow speed shafts in bronze. Shafting and pinions are stainless steel matching with spur gearing of bronze or bakelite. A simple spring clutch on the marker mechanism permits stalling such as might be caused by a failure of the tape to feed smoothly, preventing possibility of damage to the motor or gearing. On the takeup a similar clutch permits the motor to pull the tape to a maximum tension well within the breaking point of the tape and yet allows the armature to coast to a stop.

Incorporates New Switch Design

It is a common fault of cam lever switches that if the lever is permitted to snap into the home position it will overtravel and operate the contacts in the other position. To overcome this a new switch was designed having the cam notched to engage with a follower under spring pressure.

Front of cabinet is divided into two sections, each with a double hinged door. All relays, resistors and other adjustable parts which might be tampered with are left in this section, the door being locked. The rectifier as the principal source of heat is in the lower compartment. Ventilating holes conduct warm air upward to the relay compartment, keeping the wiring and parts free from moisture.

With an expected life of at least twenty-five years, the materials used are, of course, important. No unprotected steel is employed anywhere. All steel moving parts are stainless. The cabinet is parkerized before painting and other steel or iron parts are either parkerized or cadmium plated. Specially selected etching grade aluminum sheet is used for the panel and trim. Switch and relay contact springs are tinned phosphor bronze with contact points of pure silver. Electrical insulation is bakelite laminated.

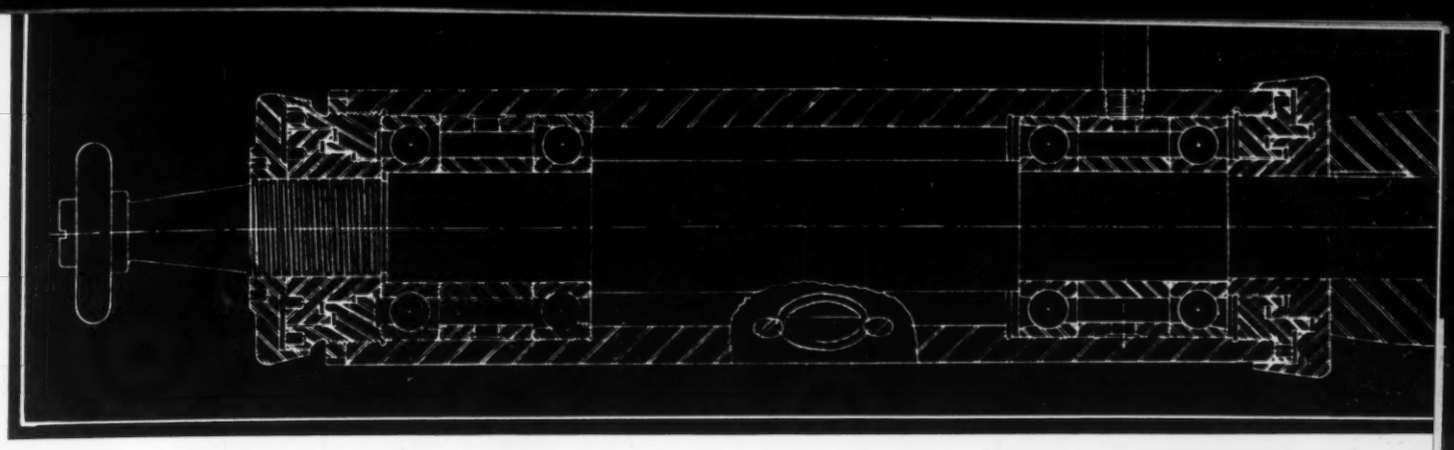
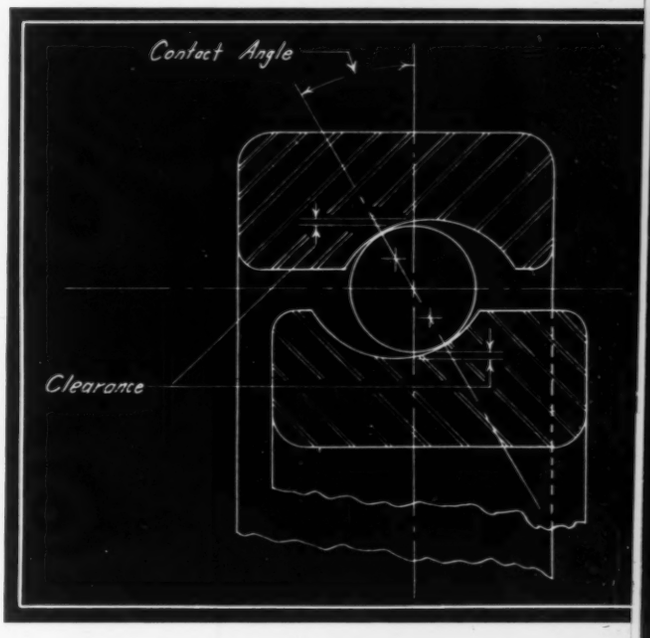


Fig. 1—Grinding wheel spindle has all four bearings fastened to shaft. Wheel end bearings are also fastened in housing

Fig. 2—Schematic sketch of angular contact bearing, indicating how the contact angle is increased by preloading

Uniformity, Accuracy Attained with Precision Bearings

By Walter F. Skillin
The Fafnir Bearing Co.



STEADY increase in new applications of ball bearings to machines and particularly to machine tools has been aided materially by the development of super-precision bearings. Selection of bearings from regular production in order to obtain refined tolerances is adequate for many applications. However, difficulties are often encountered which may be surmounted only by recourse to super-precision bearings. These bearings have been made available through the development of new manufacturing methods and the perfection of technique involving special heat treating, double grinding operations, special equipment and carefully trained operators.

The special equipment necessary has served the additional purpose of providing the manufacturers with an excellent proving ground for the new bearings. Although the final finish on ball bearing races is obtained by supplementary operations, there are few places in industry where the grinding finish must be as entirely free from chatter or mechanical imperfections.

Application of super-precision ball bearings to the work heads of race-grinding machines has practically eliminated upkeep expense. Similarly, applied as duplex pairs their use on the wheel spindles has not only greatly improved grinding accuracy and finish but also resulted in prolonged life. *Fig.* 1 shows a typical grinding wheel spindle of modern design. All four bearings are securely fastened to the shaft. Wheel end bearings shown on the left are securely fastened to the housing, thus eliminating the possibility of play. The preloading is sufficiently high to afford maximum rigidity without excessive heating. Analysis of the static deflection of this spindle under wheel and belt loads indicates that the second bearing from the wheel is at a point where little if any bending occurs. However, two test spindles in which this bearing was omitted produced satisfactory work for but 17 and 32 hours respectively. Four-bearing spindles have an average life of well over 1000 hours.

Deflections of a rotating spindle are much too complex for solution by static analysis. Any bending of the spindle due to mounting or load aggravates the dynamic unbalance and causes vibration. Chatter but

little greater in magnitude than the wave length of light is objectionable. Duplex pairs of bearings spaced as shown in *Fig.* 1 eliminate chatter by providing extra supporting points. Immediate demonstration of the stiffening effect of duplex bearings is afforded by observing the reduction in spark-out time. Faster feed of the wheel is also possible, thus greatly increasing production. This increase in production plus the increase in useful life of the spindle more than justifies the slight cost of additional bearings.

The No. 200 light series bearings have proved the best balanced design for high speed spindles, the No. 300 series having lower top speed for a given bore size, and the No. 100 series (extra light) allowing greater deflections with consequent increase in spark-out time.

Speed of the spindle determines the most suitable bearing size. In general the largest bearing capable of satisfactory operation at the speed should be chosen. Maximum speeds have been determined experimentally and vary from 42,500 revolutions per minute for the 15 millimeter bore size to 11,000 revolutions per minute for the 45 millimeter bore size.

Values of preload have been standardized to provide maximum rigidity without excessive temperature. Higher speeds may be used by reducing the preload. Comparable rigidity coupled with free running in a two-bearing spindle requires frequent delicate adjustments to maintain finish and attain reasonable life. If springs are used to establish preload, the requisite rigidity often necessitates the use of tandem pairs of bearings to withstand the heavy spring load.

Fit of the bearings to the shaft and in the housing can change the effective preload appreciably, particularly if the bearings have a high angle of contact between the races and balls. *Fig.* 2 shows, in exaggeration, the radial clearance over the top of the ball in an angular contact bearing. Pressing such a bearing into a housing or on a shaft reduces the axial rigidity by decreasing the angle of contact. Curves, *Fig.* 3, show the effect of press fit on the elastic deformation curve of a super-precision extra light series bearing having a 90 millimeter bore.

Danger of overloading is another hazard of press fitting preloaded bearings. When the ring closes in on the balls the faces try to assume new relative positions so that an increased thrust load is needed to bring the faces in line. Metal-to-metal fit between the bearing and the shaft or housing has been found to be most satisfactory for super-precision bearing installations.

Fig. 3 also shows the difference in slope of the preload curve for contact angles of 20 degrees and 5 degrees. Increased axial rigidity of the high angle bearing is apparent. However, on grinding or turning spindles the radial rigidity has more effect on finish

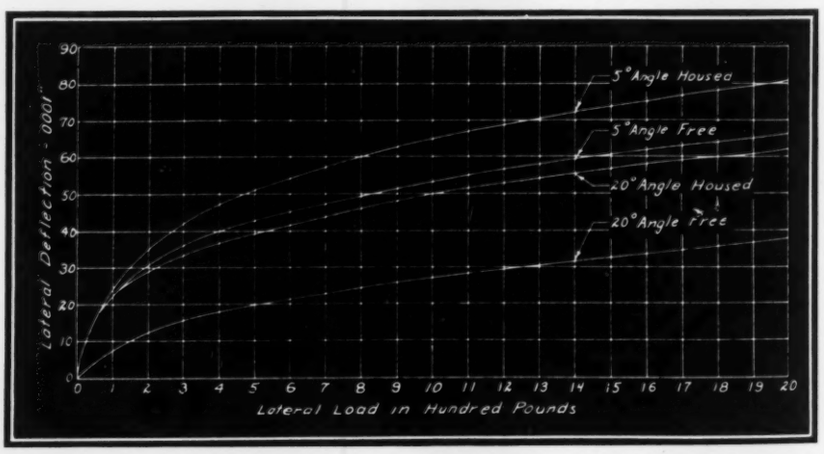


Fig. 3—Curves show the effect of an .0008 inch press fit on the elastic deformation of a super-precision bearing

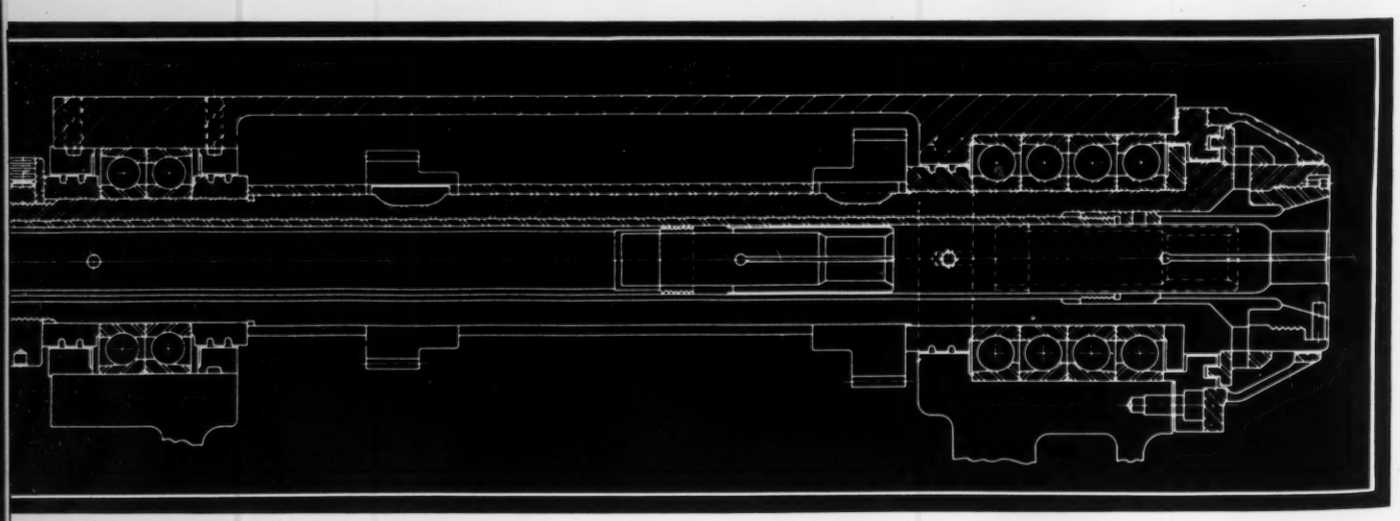


Fig. 4—Automatic machine tool spindle equipped with tandem pairs of bearings

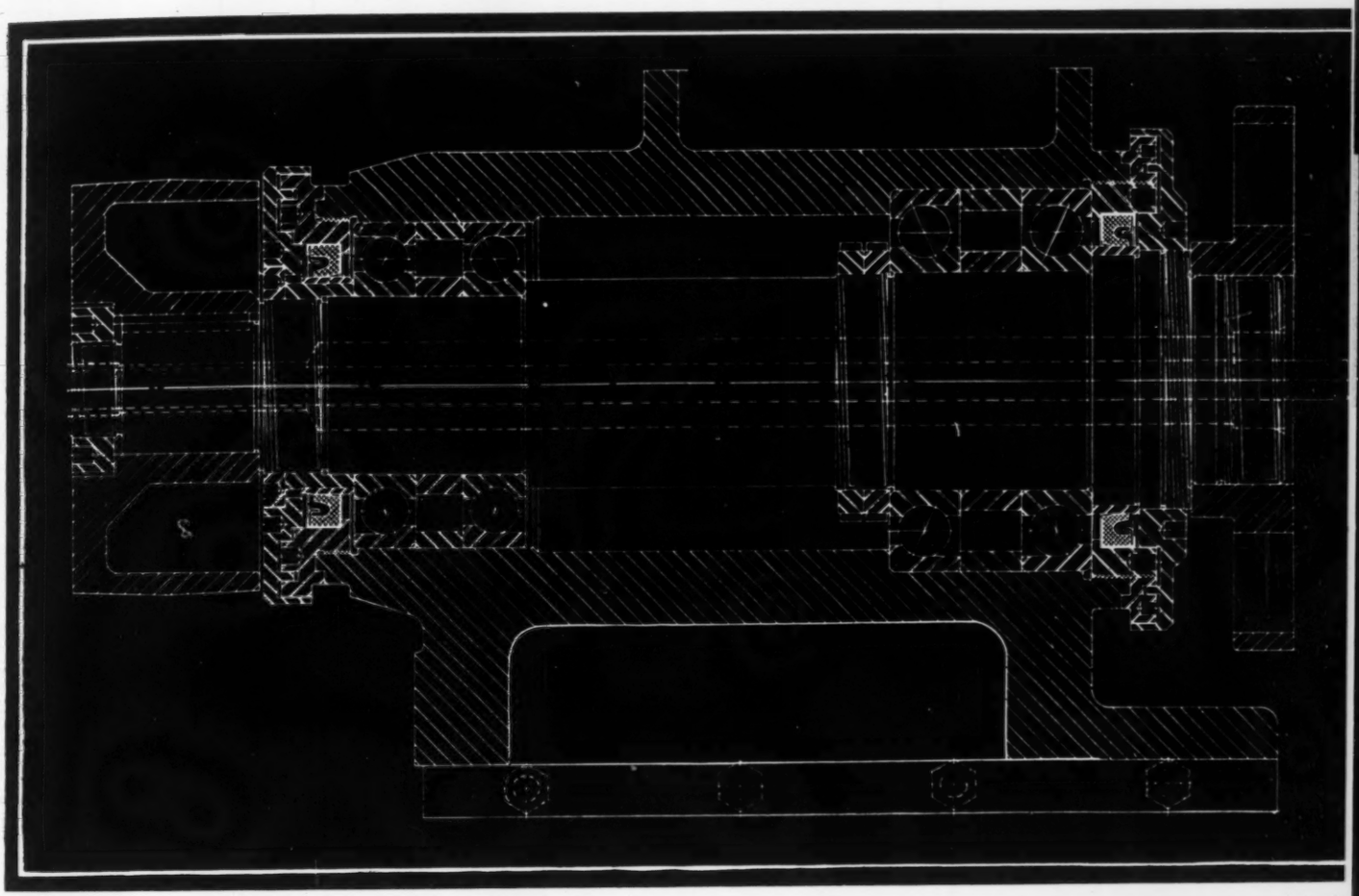


Fig. 5—Spindle for grinding outer races of ball bearings. Note the large bearing diameter for maximum rigidity

so that bearings will lower contact angle are used.

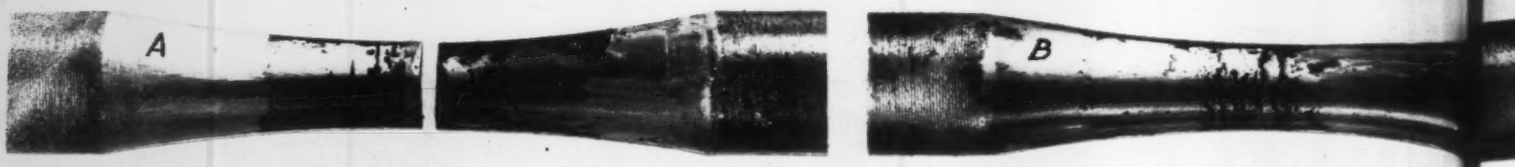
Tandem arrangement of duplex pairs of bearings shown in *Fig.* 4 avoids excessive temperatures at high speeds by allowing a conservative preload without sacrificing axial rigidity ample to resist heavy thrusts at low speed. *Fig.* 5 is a section through an outer ring race-grinding spindle. It is interesting to note that the duplex pair of bearings on the pulley end of the spindle is so opposed as to provide a maximum moment of resistance at this point of greatest bending moment.

The high degree of accuracy provided by super-precision bearings is not essential in many applications. Machine tool spindles use by far the largest percentage of these bearings. However, a great many are used in instruments—for example, on self-synchronous motors. Torque of these motors approaches zero when the receiving motor approaches correspondence with the driving generator. Friction in the bearings of the motor prevents absolute correspondence and decreases the accuracy of the system. Synchronous motors require a very snug fit in the bearing to minimize noise. Accuracy of the parts is, therefore, important in order to allow close fits to be used without increasing friction losses.

Need for finer finishes demands smooth, vibrationless machines and it is imperative that driving motors shall not cause vibrations. Use of super-precision bearings in the motor maintains the greatest accuracy of balance although "selected" bearings might be suitable for many applications.

Engineering of super-precision bearing applications is in most cases similar to that for SAE bearings. Tolerances allowed on shafts and housings, and squareness of shoulders, should be reduced to conform to the bearing tolerances. Use of two nuts rather than a lock washer is preferred. When a nut is brought up against the inner ring of a bearing the radial force applied by the wrench tends to throw the center of the nut off the center line of the shaft. The reaction of the bearing face in restraining the nut will bend the shaft. This error can be corrected by driving the nut radially in a direction opposite the wrench pull by a light tap with a hammer.

Duplex bearings are especially preferred for super-precision applications because of the need for obtaining maximum rigidity and true running. Bearing engineers are frequently asked if preloading does not reduce the useful life of the bearing. The question arises from the fact that the preload is not supporting any external load. Actually the opposite is true. As the bearings wear, the elastic deformation caused by the preload is released, thereby taking up the wear which would otherwise permit looseness. The average preload is approximately 10 per cent of the capacity of the bearing. Should an axial force become great enough to reach the capacity of either bearing, it will generally be found that the mating bearing is no longer adding to the load because of deflection unloading this bearing.



Surface Coatings Affect Propeie

EFFECT of various surface treatments and coatings on the fatigue strength of carbon and alloy steels is discussed in this article abstracted from a paper presented at the forty-third annual meeting of the American Society for Testing Materials. The authors, T. J. Dolan and H. H. Benninger, are associated with the University of Illinois

SERIOUS reduction in fatigue strength of steel is produced by the simultaneous action of a mildly corrosive liquid in contact with the steel while it is being repeatedly stressed The resistance to this type of combined action (corrosion-fatigue strength) depends chiefly on the ability of the surface material to resist localized corrosive attack; unless corrosion pitting is prevented, increase in the static strength and ordinary fatigue strength of a steel by alloying or heat treatment does not materially affect the corrosion-fatigue strength.

A significant increase in corrosion-fatigue strength of a steel could be obtained if the surface were coated or otherwise treated in such manner that the localized corrosion pits usually developed by the simultaneous corrosion and repeated stressing would either be inhibited or prevented from deepening with time.

The purpose of the investigation herein reported was to determine quantitatively the protection offered by several commercial impregnations and coatings on steel specimens subjected to completely reversed cycles of flexural stress while under the corrosive influence of a stream of fresh tap water. A comparison was made of the endurance limits of specimens tested in air with the endurance limits of coated specimens tested in water.

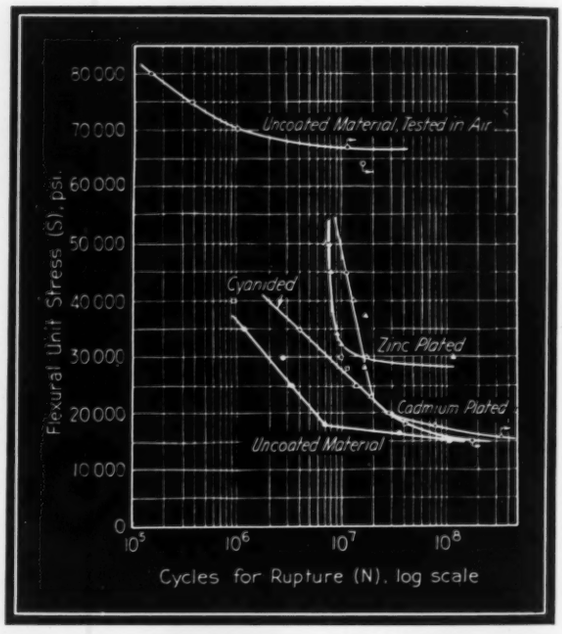


Fig. 1—Reversed flexural fatigue tests of S.A.E. 3140 steel. Tested in water unless otherwise noted

TABLE I

Protective Treatments and Coatings

Type of Steel	Preliminary Heat Treatment	Protective Treatment	Type of Coating	Thickness of Coating, in.
S.A.E. 1020	Annealed at 1610 F.	Heated 1½ hr. at 1840 F. in mixture of silicon carbide and chlorine gas, cooled in furnace	Silicon impregnation	0.02
S.A.E. 3140	Normalized at 1600 F. quenched in oil from 1510 F.; tempered at 1100 F.	Electrolytic bright zinc plating	Zinc	0.00015
		Electrolytic cadmium plating	Cadmium	0.0001
		Two coats air hardenable bakelite varnish	Bakelite varnish	....
		Two coats heat hardenable bakelite varnish, baked at 300 F.	Bakelite varnish	....
S.A.E. 3140	Normalized at 1650 F.	Heated in cyanide salt bath at 1520 F. for ½ hr., quenched in oil, tempered at 400 F.	Cyanide case	0.004
S.A.E. 6120	Quenched in oil from 1630 F.; tempered at	Heated 60 hr. at 970 F. in ammonia gas	Nitrided case	0.02

Fig. 3—S.A.E. 3140 steel after failure. Specimen A is cadmium plated; B, uncoated; C, zinc plated

ies of Steel

Effects of thin electroplated zinc and cadmium coatings, heat and air-hardenable bakelite varnishes, cyaniding, nitriding and silicon impregnation on specimens subjected to this type of corrosion-fatigue test were studied.

Tests were made on seven groups of specimens, each group of which had a different kind of protective coating, and three different steels were used in the tests: S. A. E. 3140, S. A. E. 6120, and S. A. E. 1020. A brief outline of the various heat treatments used and the methods of applying the protective coatings to specimens of each group, are shown in TABLE I.

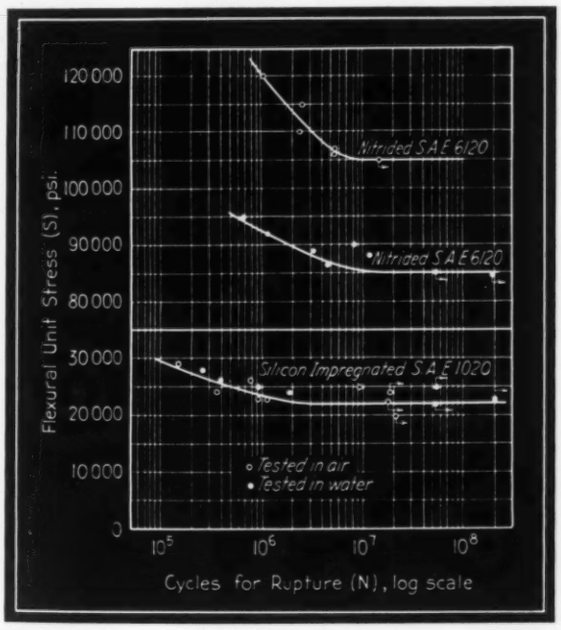


Fig. 2—Reversed flexural fatigue tests of silicon impregnated S.A.E. 1020 and nitrided S.A.E. 6120

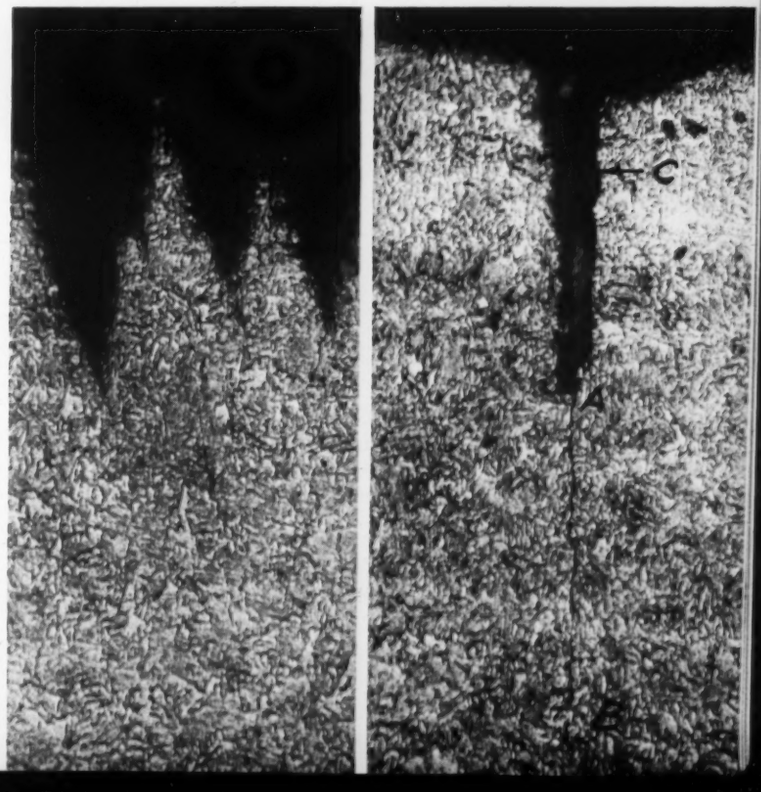
Typical failures of several specimens of S. A. E. 3140 steel are shown in *Fig.* 3. The number of corrosion-fatigue pits appearing on the surface of the coated or uncoated S. A. E. 3140 steel specimens was a function of the stress and type of coating. In general, for a given type of protective coating, the lower the stress, the fewer and deeper were the corrosion-fatigue pits when the specimen ruptured. Furthermore, the specimens with the zinc plating (which is electrochemically more active than cadmium) exhibited a larger number of small corrosion-fatigue pits than those with the cadmium plating. It is interesting to note that no visible corrosion pits were found on any of the nitrided or cyanided specimens tested; these coatings evidently offered a protection against localized corrosive pitting.

The S-N curves in *Figs.* 1 and 2 show the results obtained for each specimen tested, and the endurance limits for each type of coating were scaled from these curves as the stress which was just sufficient to cause failure in 100 million cycles of stress. Even though no definite horizontal asymptotes are obtained to the S-N diagrams for corrosion-fatigue tests, it was felt that this was a sufficiently large number of cycles of stress on which to base the relative protective value of various coatings.

Zinc and Cadmium Afforded Little Protection

The results of corrosion-fatigue tests on cadmium and zinc-plated S. A. E. 3140 steel specimens indicated that only a small amount of permanent protection against corrosive attack was produced by these coatings. From the S-N curves in *Fig.* 1 it may be observed that the life of these specimens was materially lengthened by the application of either coating if the part was subjected to cycles of stress above the corrosion-fatigue endurance limit. However, only a small increase in utilizable strength of the steel would re-

Fig. 4—Corrosion-fatigue pits in zinc and cadmium plated specimens of S.A.E. 3140 steel (x400)



sult from the thin cadmium plated coating when the part was subjected to an indefinitely large number of cycles of relatively low stress, whereas the thin zinc plating produced a definite increase in the corrosion-fatigue strength. Both of these electrolytically plated coatings were very thin and would usually be intended only for very mild service; perhaps thicker platings would produce a somewhat more effective protection.

There undoubtedly is a progressive lowering of the corrosion-fatigue endurance limit as the number of cycles of stress (and corresponding period of corrosion) are increased. After a corrosion pit has once

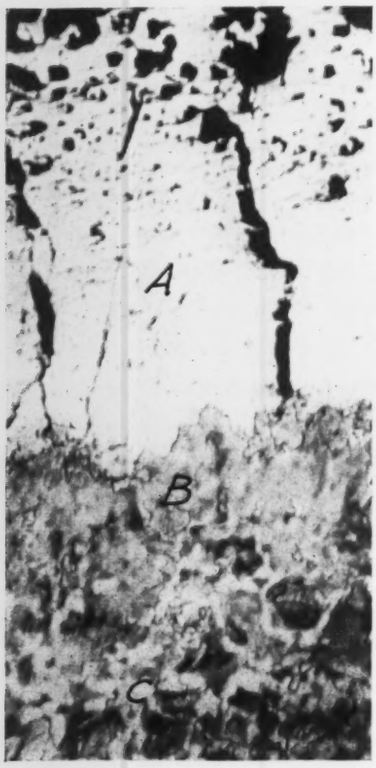


Fig. 5—Fatigue cracks in silicon impregnated case on S.A.E. 1020 steel (x100). Case A has a high silicon content; at B is a high carbon region; Core C is pearlitic low carbon steel

formed in a coated flexural fatigue specimen, it is only a question of time before the pit develops to a sufficient depth to originate a final fatigue fracture. Pits of the types shown in *Fig.* 4 were developed on both cadmium and zinc-coated specimens after several million cycles of stress while in contact with water.

Cyaniding and Nitriding Show No Corrosion

Cyaniding of the S. A. E. 3140 steel did not produce a definite increase in corrosion-fatigue strength of the specimens tested. While the specimens showed no visible signs of corrosion pitting, which would indicate a protection against corrosive action, it was evident that the carbon content of the original steel was too high or perhaps the treatment employed was unsatisfactory for proper application of a cyanide case. The specimens were extremely brittle and warped slightly in quenching. Possibly some residual stresses were also present in the specimens and the combined effect of these undesirable conditions was to lower the endurance limit materially. Perhaps a cyanide case would be effective in increasing the corrosion-fatigue strength of a low-carbon steel if the treatment could be properly controlled.

While no data are available concerning the endurance limit in air for the untreated S. A. E. 6120 steel, it can be assumed from the high endurance limit obtained (105,000 pounds per square inch) that the nitrided surface on this steel greatly increased the fatigue strength of the specimens in air. The data indicate that the nitrided case was very effective in resisting the corrosive attack and that approximately 80 per cent of the strength of the nitrided steel, as determined by the endurance limit of the material in air, can be utilized if the material is simultaneously subjected to fresh water corrosion and fatigue. The endurance limit of 85,000 pounds per square inch obtained for the nitrided specimens tested in water is higher than that obtained for specimens of most steels when tested in air and is about four times as great as the usual corrosion-fatigue endurance limits of most steels.

Silicon Has High Resistance to Water

Silicon impregnated S. A. E. 1020 steel was the only material studied that had a corrosion-fatigue endurance limit equal to the endurance limit in air. The fatigue strength of the S. A. E. 1020 steel in air was probably lowered somewhat by the application of the high silicon case; however, the corrosion-fatigue endurance limit of untreated S. A. E. 1020 steel would normally be lower than that obtained for the specimens with the silicon impregnated case. One factor which affected the strength of the silicon impregnated, low-carbon steel was the porosity of the case which developed a notch effect on the specimens subjected to repeated loading. The photomicrograph in *Fig.* 5 shows several fatigue cracks which progressed through the case of the material and in some instances started from pits in this porous surface.

TABLE II

Corrosion Fatigue Tests of SAE 3140 Coated with Bakelite Varnishes

Coating	Flexural Stress lbs./sq. in.	Cycles to Fracture
Heat Hardenable: XV 11444	40,000	2,628,300
	30,000	171,122,000*
Air Hardenable: 15 BK	50,000	5,780,100
	40,000	164,890,000*
Air Hardenable: 12 BK	40,000	14,497,800
	30,000	13,488,700

*Specimen did not fracture, but test stopped at the number of cycles indicated.

The strength of these silicon impregnated specimens in fatigue would normally be governed by the strength of the case and the notch-sensitivity of the material; perhaps the fatigue strength could be improved somewhat by close metallurgical control to prevent formation of deep pits, and by grinding off the case to a greater depth to remove most of the outer porous layer of the material. No corrosion pits were observed on the surface of the silicon impregnated specimens that were tested in water; even after two hundred million cycles of a stress in the neighborhood

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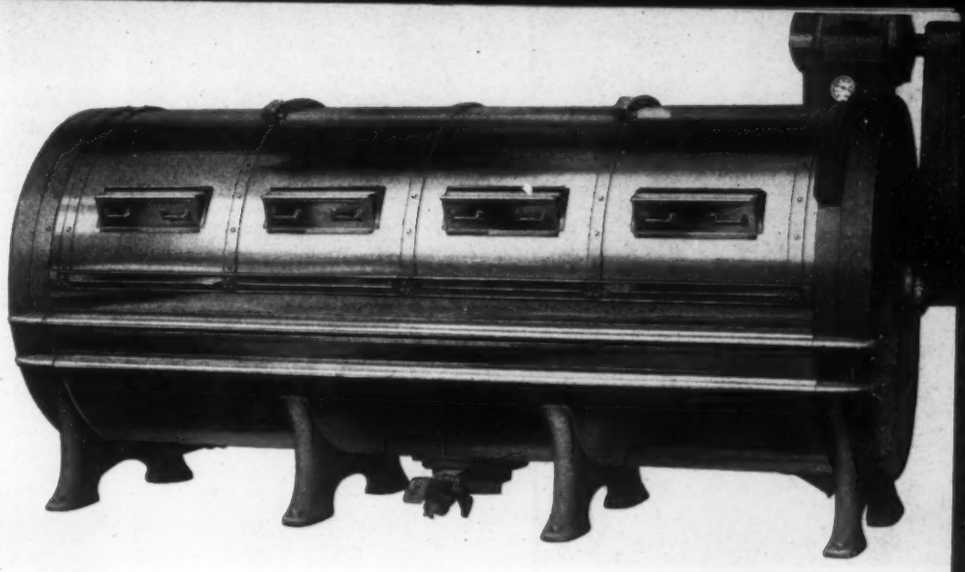
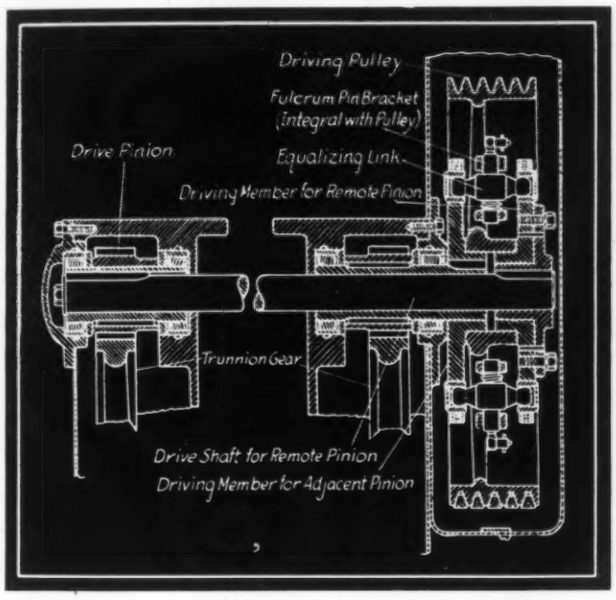


Driven from each end through sheave-contained differential, washer cylinder has no twisting stresses



Differential design utilizes whipple tree links mounted on fulcrums on sheave spider. Torque on pinion driving members is equalized by linkage movement

Balances Drive with Simple Differential

By H. H. Harlan
Troy Laundry Machinery Div.

OCCASIONALLY an age-old principle is applied in a new and interesting manner to improve the performance of a machine. In the machine illustrated this has been done with a "whipple tree" arrangement to equalize two sets of driving gears, one at each end of the machine. Otherwise the gears adjacent the drive would carry most of the load due to the natural torque deflection of the drive shaft. Also cycle reversals would cause twisting of the washer cylinder.

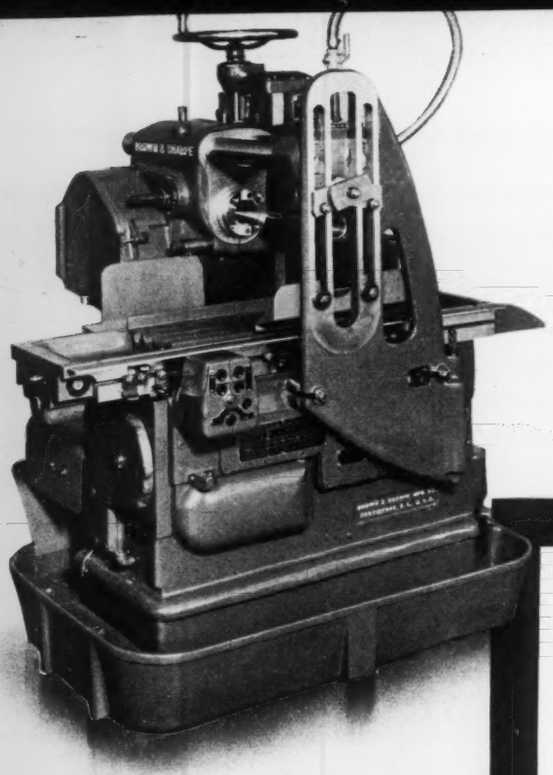
Nothing more nor less than a simple, instantaneous-aligning, driving differential arranged to assure equal driving torque to both driving pinions under any condition, the equalizing links have only three moving parts subject to wear. They are special alloy steel, hardened and ground. Lubrication is automatic from a reservoir formed within the hollow fulcrum pins through centrifugal force created by the rotating unit.

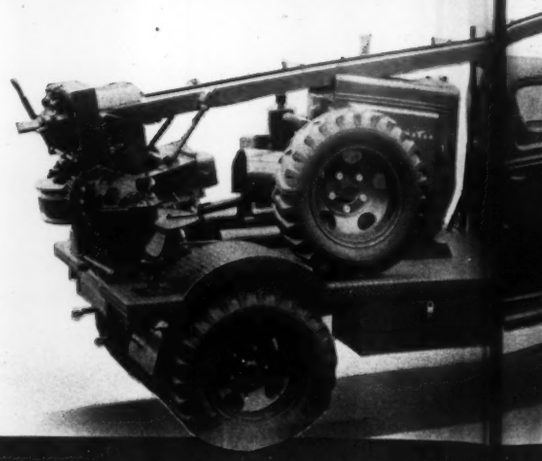
Equalizing links are designed to withstand many times the load imposed. One set of balancing parts would suffice as far as load carrying ability is concerned, yet it is desirable to use two to obtain balance of the rotating unit. Division of the load insures longer operating life.

Amount of movement of these parts is necessarily limited because they need only to compensate for any deflection of the long driving shaft. They never move more than 1/16-inch at the extreme end of the equalizing or balancing links.

Driven by a reversing motor through multiple V-belts, the sheave carries two diametrically opposite equalizing links on fulcrum pins anchored in brackets on the pulley spider. The links transmit equal driving torque to both pinion-drive members which rotate with the pulley yet are free to align themselves slightly as required. The driving members in turn drive their individually attached pinions independently as shown in the drawing. In this way driving torque at each end of the machine must be the same regardless of shaft length, deflection, or reversal of direction.

End bracket at right, shown keyed to drive shaft for remote pinion, is adjustable during assembly to compensate for any misalignment of driving keyways and keys. Driving members for adjacent and remote pinions are supported by the sleeve of the adjacent pinion and the shaft respectively, and in turn support the driving pulley.



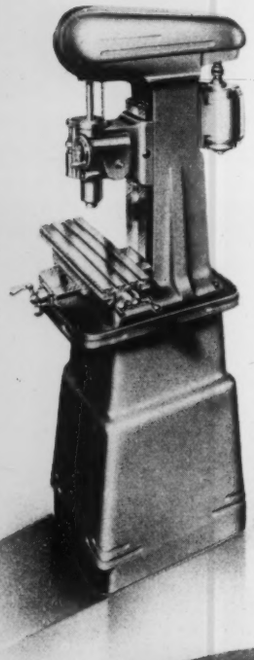


Left, top—All power movements of table and spindle of Brown & Sharpe plain milling machine are controlled by complete electrical system located largely within column. Speed and feed change gearcases are equipped with electrical interlocks, preventing operation of motors when gearcase covers are open. Column and base are one-piece castings with internal bracing

Design Feat
IN NEW MC

(For new machine a page

THIS MONTH'S COVER. Mas Clipp rolls which crack tough bolls of grain ot crus is driven by simple shaft and gear. Pl full flo obstacle is met. Adjustable V-belt sh rmit ch easily. An overrunning clutch permit inder t high speed regardless of the motion



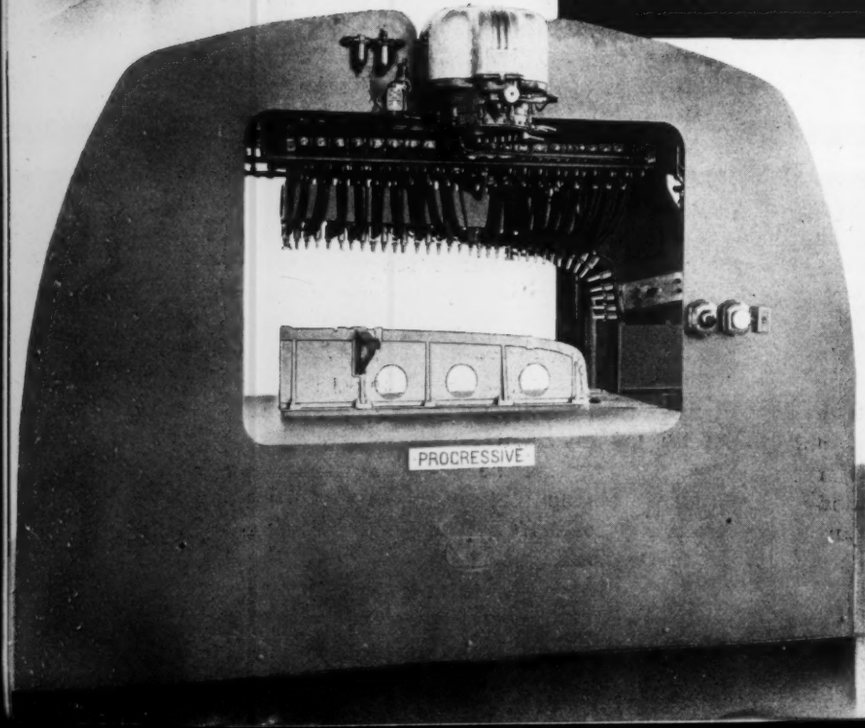
Left, center—Streamlined pyramidal design of the Vernon combination vertical milling machine and jig borer lends stability to the assembly. Knee and column are an integral, one-piece casting. Spindle is driven by a long V-belt from the motor cone pulley

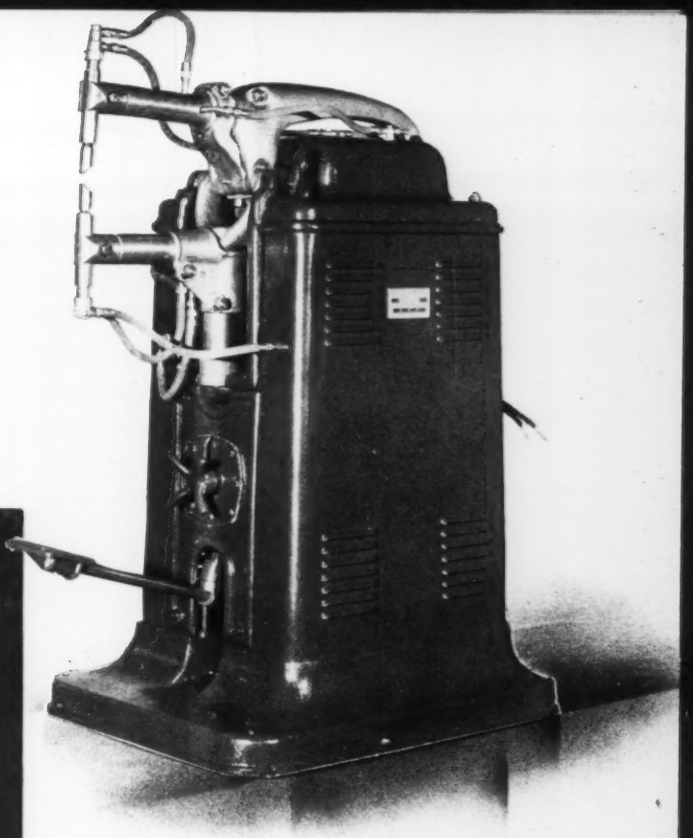
Left, bottom—A method of current transfer which makes and breaks the secondary as well as the primary circuit gives the Progress-O-Matic spot welder a speed of more than six thousand welds per hour. Welding point pressure is closely controlled and adjusted to a predetermined figure by a strong spring. A calibrated scale on each welding gun permits direct reading of pressure

Center, left, bottom—Emers adio-Re bines a radio receiver, pho and re chine in one unit. A larg ntenna Separate tone arms are use cording back programs. Cabinet is ut with band of figure-striped walnut edge-to

Center, top—Power unit of Buda-Hubron earth drill, available for military use, is a four-cylinder, watercooled gasoline engine with magneto ignition. Drive from engine to drillhead—which houses gears, clutches and brake—is by universal joint assembly. Drill helix is lifted from ground by chains and sprockets on each side of spindle

Center, right, bottom—Cu grinding attached directly to shaft enclose motor in Preis bench mo er for engraving cutters. Cutter-ho ndle is





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...s Clipper combine has rubber ...ot crush seed. Sixty-inch reel ... full floating, free to raise if an ...rmit changing cylinder speeds ...inder to rotate momentarily at ... motion of machine

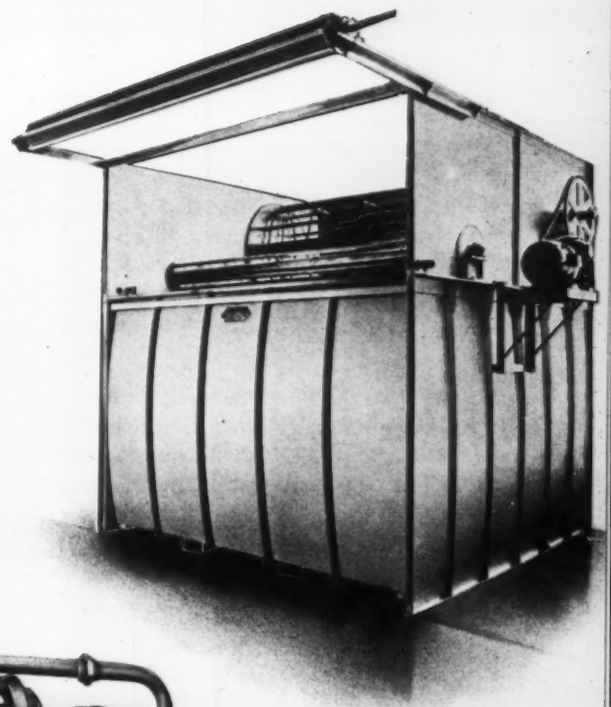
...radio-Recorder com- ... and recording ma- ...antenna is built in. ...ording and playing ...nut with contrasting ... edge-toning at base

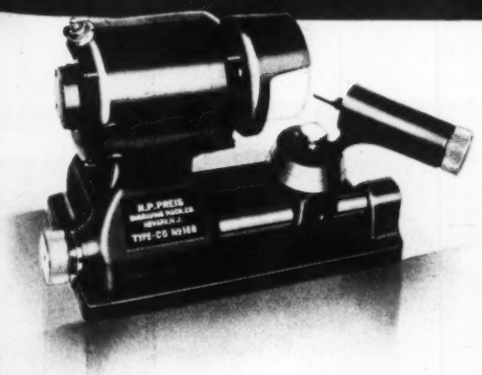
...grinding wheel is ... enclosed universal ...er for sharpening ...ndle is mounted in a swivel arm which is graduated for quick setting to any cutting angle or taper desired

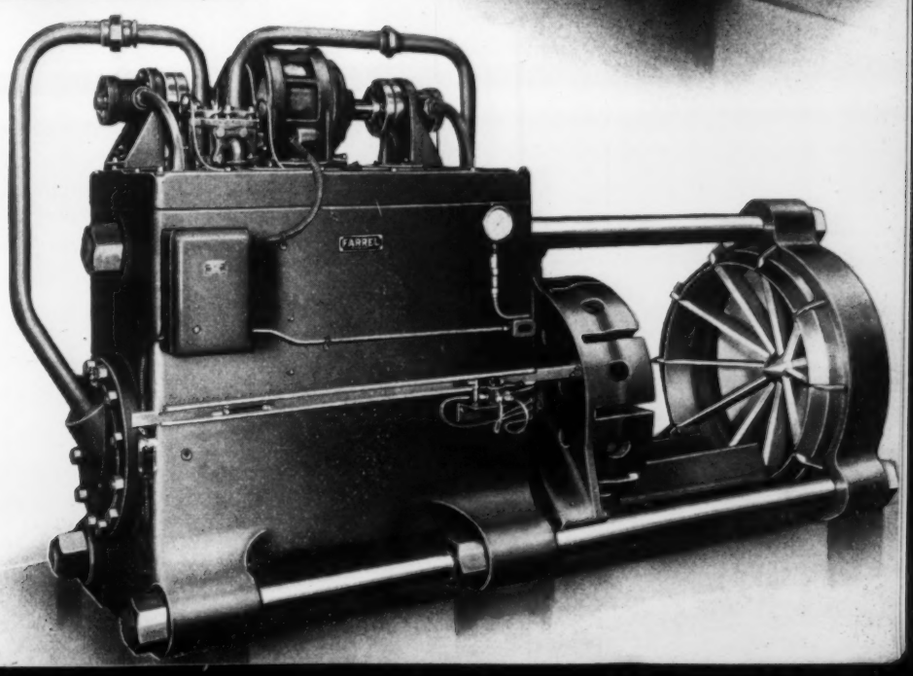
Right, top—Water keeps electrodes cool by circulating close to the welding points of the AEF spot welder. A heat regulator varies current strength to suit different materials and metal thicknesses. Automatic switch regulates initial pressure, timing of heat and final follow-up squeeze. Great rigidity is contributed to lower arm in operation by one-piece horn socket. Lower arm is swiveled to permit up, down and sideways adjustments

Right, center—Strength is attained in Rodney Hunt dyeing machine by curving the sides of rectangular stainless steel tanks so there will be no flexing or bending of the sides when loading or emptying. Great pressure can be withstood and joints are not weakened. A "pipe body" construction of the stainless steel reel permits building reels up to thirty feet in length. Drive is by roller chain

Right, bottom—Three tie rods instead of four as formerly, permit easier loading in the Farrel-Birmingham rubber bale cutter. Two hydraulic pumps driven by the same motor provide rapid approach to the work and quick return of the crosshead to starting position. Manual operation of small pilot valve starts stroke of crosshead, and movement of ram may be reversed at any point of stroke by means of pilot valve. Hydraulic cylinder and tank are one casting







MACHINE DESIGN

Editorial

Engineering Department Changes Essential Due to Shortage of Designers

SCARCITY of designers is daily becoming a more serious problem for machinery manufacturers. In most respects a regrettable condition it is one that is not likely to improve, chiefly because of the current higher tempo of production activities, the new designs involved in defense requirements, the speed with which armaments and machines for producing them must be turned out, and the greatly increased quantity of mechanical equipment that will be in demand for some years to come. Conversely, man-power will probably be less available due to the call for National Guard service and some form of compulsory military training.

It goes without saying that chief engineers of companies manufacturing many different kinds of machines are in for a difficult period and that those who have omitted making employment plans for the future will suffer some sad disappointments. Then there will remain only one resource—to build up the working capacity of available engineering staffs.

One way to carry out such a project effectively which is already being acted upon by machinery companies is to reorganize the engineering department. Offices that are much more open and better ventilated (even air-conditioned) are becoming the rule, lighting is being given primary consideration, and new standard engineering department equipment is having its full share of acceptance.

Among the more unconventional or supplementary types of equipment, there are indications of a decided trend toward employment of hardness testing devices, surface measuring instruments, polariscopes, stroboscopic devices and other aids to modern design. Not all companies have the progressiveness or even the resources to take advantage of these to the full but the day is not far distant—particularly under the stress of conditions mentioned above—when engineering departments will need to utilize all the most effective tools at their command.

The nation's well-being rests on creative, sound mechanical design. With the demand greater and less men available, the load on each will be heavier. It is in the hands of company managements to keep that load within small enough limits to insure the best and most productive return.

Professional Viewpoints

" . . . . should help designers"

To the Editor:

THE article by F. E. Hamilton in the June issue, "Continuous Development Perfects Business Machine," is an interesting article as it goes thoroughly into the steps which must be taken in developing machines. It is so seldom we think of the numerous steps taken to arrive at a finished design, especially the individual steps the author so clearly speaks of. This should help designers to keep trying, also to maintain a record of what has been tried.

Methods developed for lubricating mechanisms are interesting. Mr. Hamilton clearly shows the disadvantage of grease lubrication for the mechanisms he discusses. Few designers realize that after a path is cut through the grease there is no more lubrication. The method finally used here of pumping the oil on the gears simplifies oil seal problems. Also, churning of the oil from gears dipping into a bath is obviated. Churning often causes heat which is blamed on some innocent bearing.

—U. SETH EBERHARDT, Vice President
Newark Gear Cutting Machine Company

" . . . . given primary consideration"

To the Editor:

FROM Mr. F. E. Hamilton's article "Continuous Development Perfects Business Machine," it was indeed encouraging to note that the lubrication of this particular machine was given primary consideration during its development. In all too many cases in the past and even in some instances at present, lubrication is considered secondary to other features and given virtually no thought until the development work is completed. Even a casual inspection of many a machine often will show that practically no thought was given lubrication during the development stage and someone realized at long last that it would be necessary to lubricate it. In consequence, the result is an inadequate, inefficient make-shift system incompatible with the design as a whole.

The business machine and similar machines offer some perplexing lubricating problems. Such machines are operated generally by persons who are not mechanically minded. Because of the cleanliness of the surroundings it is necessary that the lubrication system of these machines be absolutely free of leakage and require a minimum of attention.

These machines are composed of a multiplicity of relatively small parts, accurately made and synchronized to perform definite functions at exact time periods. It is essential for proper performance that the original accuracy, timing, and ease of movement be maintained to a large degree over a considerable period of time. Consequently, lubrication must be such that friction and wear are reduced to a minimum. As mentioned above, it is gratifying to see that these factors are so well taken care of in the particular machine under discussion.

—JAMES I. CLOWER
Virginia Polytechnic Institute

" . . . . most powerful tool"

To the Editor:

MACHINE DESIGN should be commended on its far-sighted point of view with regard to the significance of photoelasticity in machine design problems. It is no doubt the most powerful tool as yet developed for the practical determination of exact stress distributions. I feel that Mr. Orton, in his recent series of articles, has performed a valuable service for engineers and designers.

—MAX M. FROCHT
Carnegie Institute of Technology

" . . . . is an insurance"

To the Editor:

REFERRING to your recent article on the use of microfilm for filing, we were, I believe, the first industrial to use it. Our use is as an insurance precaution purely. The records are deposited in our bank vault, with a silent prayer that they may stay there, for only after a major catastrophe from fire or other cause would they need to be used.

Before adopting this system extensive tests were

(*Concluded on Page* 95)

Men of Machines

A PIONEER in radio engineering, Lewis M. Clement has recently become manager of the engineering division of The Crosley Radio Corp. He is in charge of engineering and research of the company's line of radios, refrigerators, ranges, washers, automobiles and other machines.

Before becoming connected with Crosley he was chief engineer of Radio Corp. of America, of which he also was vice president in charge of research and engineering. Other important executive positions Mr. Clement has held were with companies such as Westinghouse Electric & Mfg. Co., Western Electric Co., International Telephone & Telegraph Co., Kolster Radio Inc., F. A. D. Andrea Inc., and The Marconi Co. His engineering experience has covered many countries and every phase of radio, and has brought him into contact with mechanical engineering problems outside his present field which should be invaluable in his new post. Mr. Clement is a graduate in electrical engineering, University of California.

LEWIS M. CLEMENT

IN RECOGNITION of his engineering ability John G. Bergdoll has been assigned the duties of chief engineer of York Ice Machinery Corp. He had been assistant chief engineer for some time.

A native of Pennsylvania, Mr. Bergdoll was born in 1898 and graduated with a degree in mechanical engineering from Lehigh university in 1920. He joined the York company in 1914 as machinist's apprentice in connection with York's high school co-operative course. Since then he has risen rapidly through the ranks as draftsman, equipment development engineer, product engineer, assistant chief engineer and now chief engineer. Mr. Bergdoll is credited with obtaining twelve patents from the government and has been associated with the development of some of the company's equipment for air conditioning. Recently he has taken an important part in work being done on unitary apparatus for air conditioning and refrigeration.

JOHN G. BERGDOLL

HIS professional career being entirely devoted to the field of electrical engineering, the nomination of Royal Wasson Sorensen, professor and head of the department of electrical engineering, California Institute of Technology, as president of the American Institute of Electrical Engineering seems fitting. Receiving degrees of bachelor of science in electrical engineering in 1905, electrical engineer in 1928, and honorary degree of doctor of science, he is admirably equipped for the presidency of the institute.

Beginning in 1905 in the test department of General Electric Co. he rapidly advanced to foreman of the transformer test department and later entered the commercial section of the transformer engineering department. He was then transferred to the Pittsfield, Mass., transformer works. In 1910 he was made associate professor of electrical engineering in charge of the department at Throop Polytechnic Institute (now California Insti-

(*Continued on Page* 102)

ROYAL W. SORENSEN

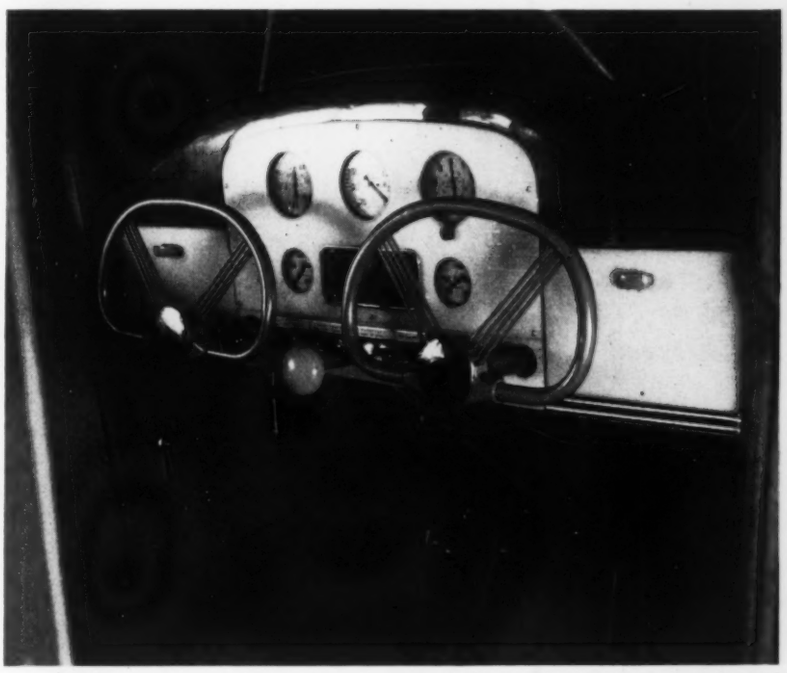
Applications

OF ENGINEERING PARTS AND MATERIALS

PLASTIC moldings combining utility and decorativeness in line with modern trends in design are well exemplified by this instrument panel molded of Monsanto polystyrene, a relatively new plastic. The panel is shown installed in the cockpit of an Aeronca Super Chief, the latest design for private flying. These planes are intended for use in regions varying in temperature from 120 degrees down to 30 or 40 below zero with wide variations in humidity. The plastic must withstand these extreme conditions without distortion or warpage, requirement to which polystyrene is well adapted.

In addition, polystyrene has very low specific gravity, important in plane engineering, and has high impact strength. The rich cream color of the plastic fits appropriately into the modern styling of the cabin.

The panel, believed to be the largest injection molding of polystyrene, is produced for Aeronautical Corporation of America, builder of the Aeronca, by the Metal Specialty Co. and Thermoplastics Inc.



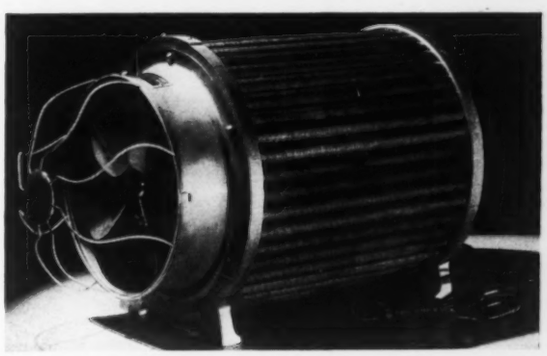
Polystyrene thermoplastic contributes to attractive appearance of instrument panel in cabin of private airplane

Activated Carbon Adsorbs Gases

HIGHLY activated, gas-mask grade, cocoanut shell carbon constitutes the odor adsorption medium of the unit illustrated, developed by the Dorex division of the W. B. Conner Engineering Corp. The carbon will adsorb usually up to about 20 per cent by weight of odorous gases. In ordinary service this is the equivalent of from three to five years operation after which the carbon units may be replaced.

Depending upon the method of activation, many different gases may be adsorbed by activated carbon. Using ordinary methods, the extremely odorous sulphur dioxide and hydrogen sulphide are easily removed from air in the concentrations in which they ordinarily occur. The material has a strong affinity for oxygen when specially activated in a nitrogen atmosphere. When treated with certain copper salts it will efficiently adsorb hydrogen cyanide.

In considering the use of activated carbon to eliminate contamination resulting from the presence of



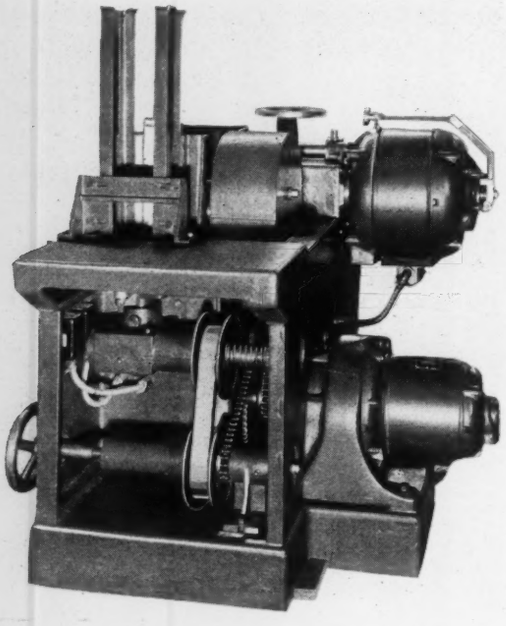
Activated carbon used in Odorsorber will also remove other undesirable gases

objectionable gases (in equipment for the food industry for example) special precaution should be taken because of the nature of the material.

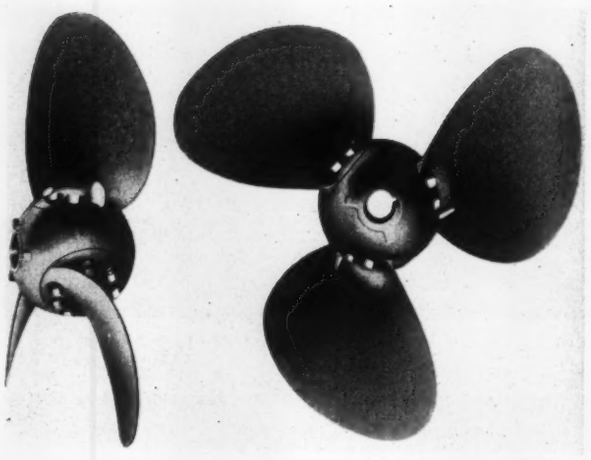
Two Vari-Pitch Pulleys Control Speed

SPEED control is attained by the use of two Reeves adjustable pitch pulleys on this high-speed groover of separator plates for storage batteries. The machine was developed by Charles F. Bamford, Portland, Oreg.

Main drive is through a gear head motor. Two sprockets are mounted on the output shaft of the motor. One drives the feed rolls through a roller chain thus providing a constant rate of speed; the other sprocket drives the countershaft on which one Reeves pulley is mounted. Bearing assembly provides an adjustment on one of the disks (shown on the lower shaft in illustration). This pulley drives the upper pulley which is equipped with a standard spring takeup. Use of two variable speed pulley assemblies permits mounting on shafts of fixed center distance, resulting in a flexible and compact design.



Adjustable rate of feed is provided by use of two variable pitch pulleys



Separate nickel iron castings are employed for hub and blades of evaporator impellers

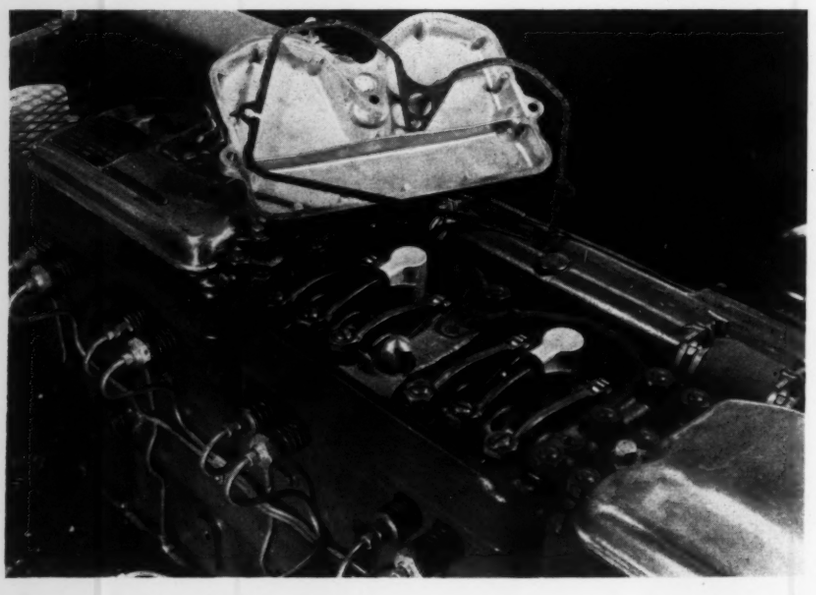
Nickel Iron Used in Impellers

NI-RESIST proves an efficacious casting alloy in services subject to conditions of corrosion and erosion as demonstrated by the above impellers for salt evaporators at the St. Clair, Mich. plant of Diamond Crystal Salt Co. Their design based upon a wide marine experience, the impellers constitute a noteworthy part of the installation produced by the Federal-Mogul Corp. for this severe service.

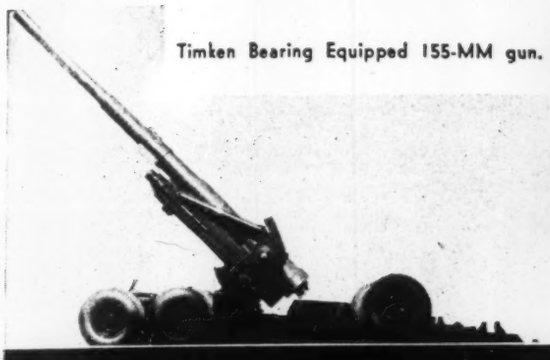
Gasket Resists Heat, Corrosion

ASBESTOS and neoprene combined by an entirely new process which retains the desirable features of both materials make possible a gasket developed by the Victor Mfg. & Gasket Co. The gaskets are made in two forms: One for use where relatively light flange pressure is applied as between light metal stampings; the other for higher flange pressures as between machined surfaces.

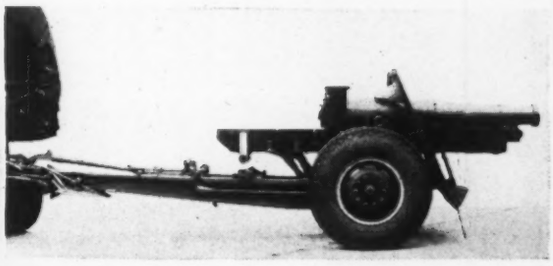
The material is claimed to withstand immersion for 400 hours in 50 per cent water solution of glycerine at 200 degrees Fahr. and ethylene glycol at 180 degrees Fahr., with only slight effect on flexibility, strength, dimensions or resilience.



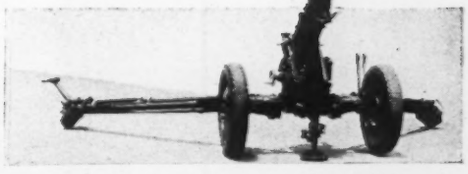
New asbestos-neoprene cover gasket for diesel rocker box affords long life in severe service



Timken Bearing Equipped 155-MM gun.



Timken Bearing Equipped 155-MM howitzer.

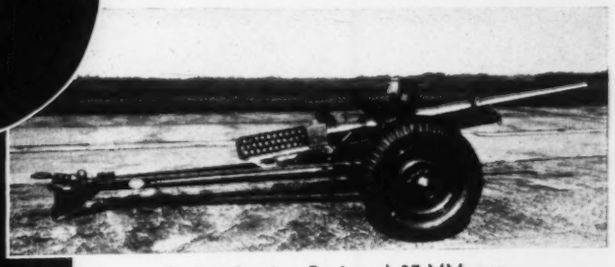


Timken Bearing Equipped 75-MM field gun.

For Defense

Wherever wheels and shafts turn, the extra strength, endurance and accuracy of TIMKEN Bearings are facilitating the mechanization of our military forces . . . both in the equipment itself and in the precision machinery necessary to produce it.

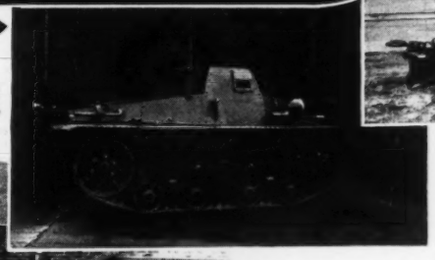
THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO



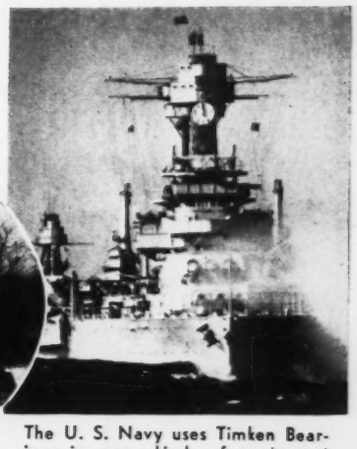
Timken Bearing Equipped 37-MM gun.

Timken Bearing Equipped light tank. →

Timken Bearing Equipped 4-ton truck. ↓

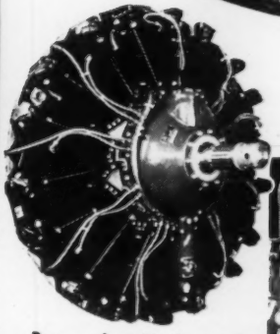


Timken Bearing Equipped 1½-ton truck. ↓

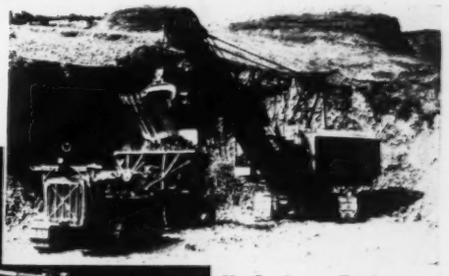


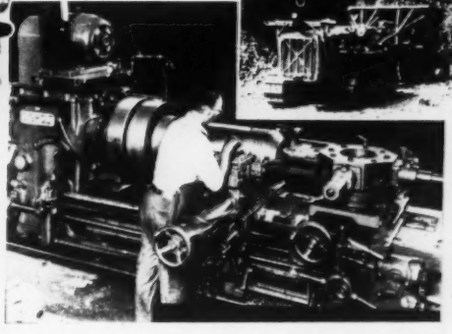
The U. S. Navy uses Timken Bearings in many kinds of equipment afloat and ashore.

U. S. military airplanes take off and land on Timken Bearing Equipped wheels.



Power for U. S. war birds—Timken Bearing Equipped engines.





U. S. Army Engineers use a wide variety of Timken Bearing Equipped machines.

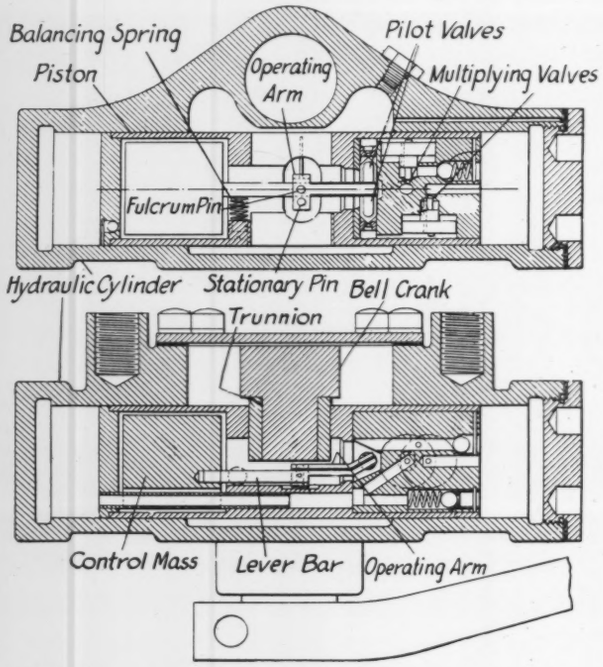
Millions of dollars worth of Timken Bearing Equipped precision machine tools will speed up our vast defense program.

Noteworthy PATENTS

Reference Mass Damps Road Shocks

DIFFERENTIATION between oscillation of the sprung and unsprung loads is achieved by means of reference to a control mass substantially independent of the vehicle in a shock absorber invented by Clinton R. Hanna (patent No. 2,193,591) assigned to Westinghouse Electric & Mfg. Co.

The device consists of an hydraulic cylinder fastened to the sprung load or chassis; contained in the cylinder is a piston, the right end of which accommodates necessary relief and multiplying valves. A bell crank, one arm of which is attached to the axle housing and



Damping vertical chassis movements, shock absorber permits free oscillation of wheels

the other through a trunnion and collar constrained in a recess in the middle of the piston, operates the piston in the cylinder.

The novel feature of this design is the use of a freely floating control or reference mass contained in the left side of the piston. The effect of gravity on this mass is counteracted by the balancing spring. Rigidly attached to this mass is a lever bar which operates the pilot valves. This bar is pivotally attached by means of the fulcrum pin to an inverted U-shaped saddle which is in turn pinned to the cylinder by means of the stationary pin. Integral with this U-shaped member is a second pilot valve operating arm.

Thus, the control mass is permitted two degrees of freedom: Rotational about the fulcrum pin, and tranlational parallel to the axis of the cylinder producing rotation of operating arm about the stationary pin.

When the chassis is positively accelerated upward relative to the axle, the control mass lags behind, due to its inertia thus closing the upper pilot valve. At the same time the piston is moved to the left by the bell crank producing a high pressure in the left end of the cylinder. Fluid then flows through the upper multiplying valve to the right end of the cylinder, effectively damping the motion.

If the unsprung load is accelerated upward, i.e., as in running over an obstruction in the road, the piston is moved to the right, the control mass lags this motion and causes the operating arm to permit the lower pilot valve to open thereby affecting free flow from the right end of the cylinder to the left so that the transfer of the shock to the sprung load is reduced.

Speed Measured by Inertia

KINETIC energy of rotation stored in a flywheel is used as a measure of speed in a tachometer which requires only brief contact with the rotating part and can be read at leisure after removal. Patent 2,193,646 covering this device was issued to Theodore A. Rich and assigned to General Electric Co.

As shown in the illustration the tachometer consists of a flywheel mounted on a shaft which is permitted a small axial displacement. In the position shown, the thrust spring has forced the flywheel to the left so that its plane face is in contact with the friction wheel. The shaft to which the friction wheel is fastened is connected by appropriate gears to another shaft which moves the pointer. Rotation of the pointer shaft is opposed by the torsion spring. The adjustment bar permits the worm gears to be shifted for clockwise or counter-clockwise rotation.

In operation, the flywheel shaft is pressed against

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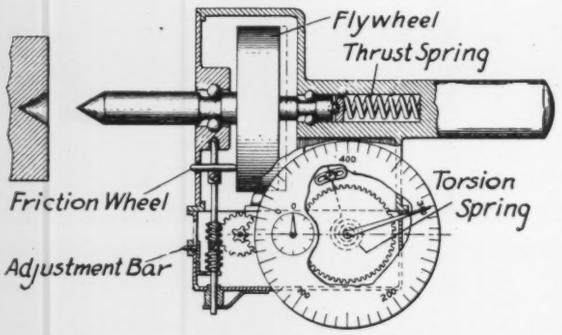
THE STABILIZED TRACING PAPER

the center of the rotating member whose speed is to be measured. The flywheel is thus moved to the right against the thrust spring and out of contact with the friction wheel. As soon as the flywheel comes up to speed, the tachometer is quickly removed from the rotating piece. The thrust spring then forces the flywheel to the left into contact with the friction wheel. The kinetic energy of the flywheel (which is,



Tachometer employs flywheel inertia to measure speed of rotating shaft

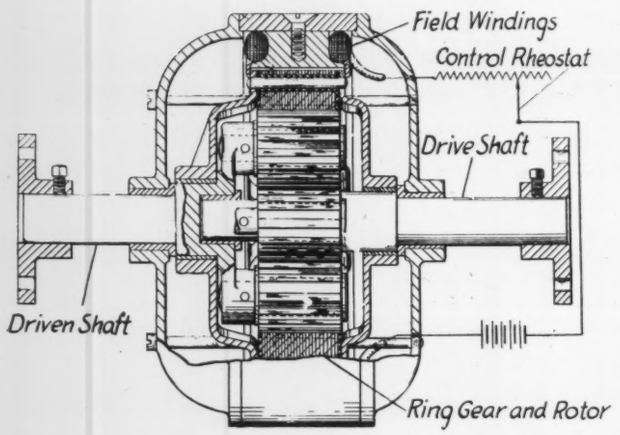
of course, proportional to its speed) is thus expended in winding up the torsion spring and at the same time moving the indicating pointer over the calibrated scale.

Electric Brake Varies Speed

AN ELECTRODYNAMIC brake is employed to resist the rotation of the internal ring gear in a variable speed planetary gear transmission disclosed in patent No. 2,180,474 issued to Bennett M. Leece and assigned to The Leece-Neville Co., Cleveland.

The ring gear is an integral part of a squirrel-cage type rotor which is mounted on bearings co-axial with the driving and driven shafts of the transmission. Field windings within which the rotor revolves are energized by means of an auxiliary source of power. Conventional planetary gearing is utilized.

Speed control may be obtained by a rheostat in series with the field windings. Increasing the ampere turns of the field by reducing the resistance of the



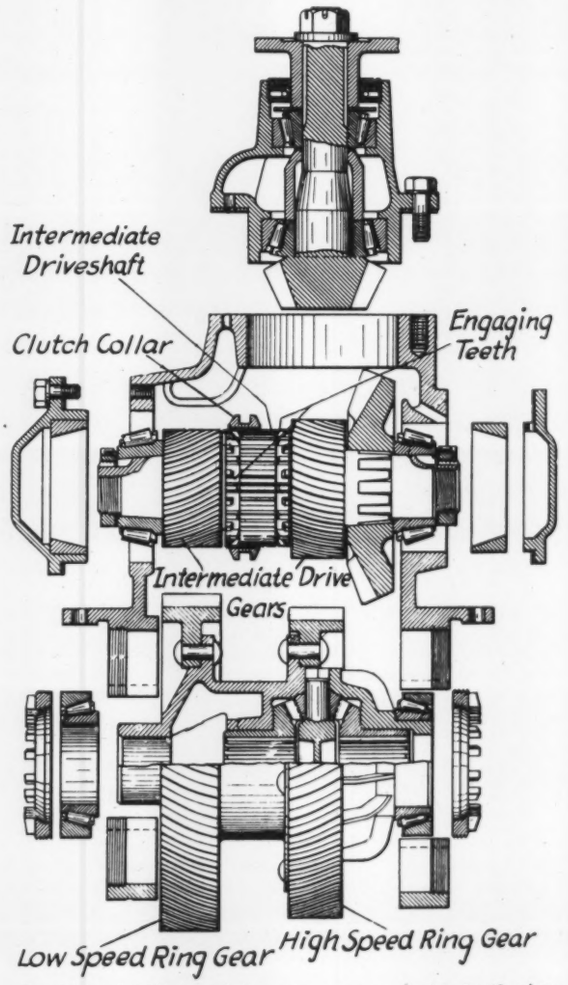
Electrodynamic brake effects speed control in planetary gear transmission

rheostat will, by increasing the braking effect on the rotor and hence the ring gear, increase the speed of the driven shaft.

Clutch Facilitates Gear Change

Alternately cut-back and chamfered teeth on the engaging surface of the intermediate drive gears promote ease of speed change in this dual ratio drive axle. Patent 2,183,667 issued to L. Ray Buckendale and assigned to the Timken-Detroit Axle Co. claims also ready accessibility for lubrication and ease of assembly.

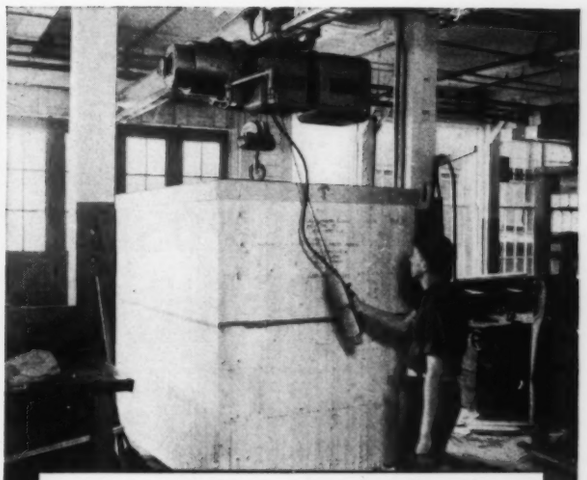
Involute spur teeth are cut on the cylindrical surface of the intermediate drive gears, coinciding with similar teeth on the intermediate drive shaft. Alter-



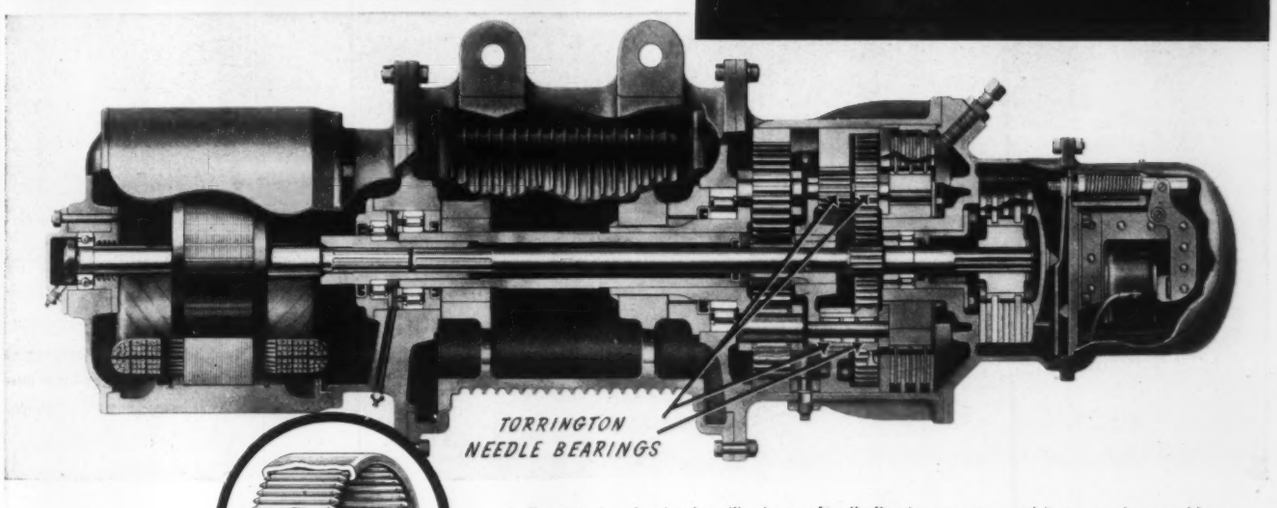
Design of differential gear cage permits both ring gears to be assembled as a unit

nate teeth are then cut back about half their width. The internal teeth on the clutch collar are in permanent engagement with the shaft. These internal involute teeth are also alternately cut back. Thus easy engagement with one or the other of the intermediate drive gears is assured. The collar, by means of an operating fork, can be slid either to the right or left engaging one or the other of the drive gears which float on the shaft.

SHEPARD NILES *LIFT ABOUT* HOIST adopts TORRINGTON NEEDLE BEARINGS on ALL counts



The "Lift-About" Hoist on the job. High radial load capacity—provided by many linear inches of contact—makes the Needle Bearing ideal for hoisting service applications.



Cross-section showing how Torrington Needle Bearings are mounted in gear train assembly.

"For our Shepard Niles Electric Hoists," say the Company's engineers, "Torrington Needle Bearings were selected because of their small size, high load carrying capacity, ease of installation and low cost." So, like many other manufacturers, Shepard Niles Crane & Hoist Corporation found in Torrington Needle Bearings exactly the features they required.

Perhaps you, too, can incorporate the many advantages of this unique bearing in *your* product. Consider these features:

SMALL SIZE: Because the Torrington Needle Bearing is small radially and long axially, it requires only the simplest type of housing structure—no more space than a simple bushing.

HIGH LOAD CAPACITY: The Needle Bearing's full complement of small diameter needles gives many inches of linear contact, resulting in high radial load capacity.

EASY INSTALLATION: The design of the bearing—long axis and small diameter—permits the use of an extremely simple form of bore housing. And being a single unit, the bearing can be pressed into position with an ordinary arbor press.

EASE OF LUBRICATION: Lubrication is extremely simple, efficient and thorough. The turned-in lips of the retaining race form a natural reservoir for grease or oil—holding ample quantities for long periods of operation without renewal.

LOW COST: Because of its simple design, the Torrington Needle Bearing, compared to other types of anti-friction bearings, is surprisingly low in cost.

All these factors become tangible values in the cost accounting of the production line. And perhaps only a minor change in the design of your product will enable you to take advantage of these important cost savings. Further information is given in our Catalog No. 9 which will be sent on request. For Needle Bearings to be used in heavier service, ask for Booklet 103X from our associate, Bantam Bearings Corporation, South Bend, Ind.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.
Makers of Needle and Ball Bearings

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"Pack-less"
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GIVE YOU POSITIVE
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HANNIFIN disc-type Air Control Valves give the positive and accurate control of air operated equipment that means economical use of air power, and smooth easy handling. These valves have no packing, and no leakage or packing maintenance troubles. The bronze disc controlling air flow is ground and lapped to form a perfect seal with the seat, which is similarly finished.

Hannifin Valves are made in 3-way and 4-way types for various standard cycles of operation, for control of single and double-acting cylinders, for air or hydraulic pressures up to 150 lbs. per sq. in. Built in the following models: Standard 3-way and 4-way hand control valves; Duplex valves for control of two double-acting cylinders; Spring return for instant reversal upon release of pedal; Heavy-duty rotary valves; Foot operated treadle valves; Electric models for remote control; Manifold types for control of several units.

Also piston type pressure regulating valves for uniform, economical operating pressures for individual machines.

Write for Valve Bulletin 34-MD with complete specifications of all types.

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HANNIFIN VALVES

ASSETS to a BOOKCASE

General Engineering Handbook

Edited by C. E. O'Rourke; published by McGraw-Hill Book Co. Inc., New York; 1120 *pages,* 6½ *by* 8 *inches, cloth bound; available through* MACHINE DESIGN *for* $4 *postpaid.*

Specialists in different phases of engineering have contributed chapters to the second edition of this book, which is exactly what its name implies. First published in 1932, it makes no attempt to supplant detailed handbooks devoted to separate branches of engineering. Its aim is to supply a compact reference work containing important fundamentals for all engineers. Also back of the conception of the book is the assumption that at one time or another a member of one division of the engineering profession will require information normally belonging to one of the other divisions.

It should be pointed out that in order to incorporate all the desirable material in a single volume it was necessary to reduce to an absolute minimum, general descriptive matter, historical facts, highly specialized material, discussions as to relative merits of various methods of solution, derivations of equations, developments of theories, etc.

In the second edition a great many of the specialized sections of the first edition have been eliminated, while basic sections have been expanded. Fundamental sections like those on mathematics, materials, mechanics and hydraulics have been rewritten entirely. Engineering thermodynamics, electrical engineering principles and structural theory and design have been discussed more fully.

□ □ □

Mechanics Applied to Vibrations and Balancing

By D. Laugharne Thornton; published by John Wiley & Sons Inc., New York; 529 *pages,* 6 *by* 10 *inches, cloth bound; available through* MACHINE DESIGN *for* $7.50 *postpaid.*

The general theory of vibrations in its various aspects is presented in this book. Examples and applications of the theory in each chapter give added meaning to what would otherwise be abstractions, and show the relations of the subject to several spheres of engineering. Topics covered include balancing of engines, balancing of locomotives, theory of vibrations, propagation of stress in elastic materials, beams and plates, rotating shafts and disks, and a general survey.

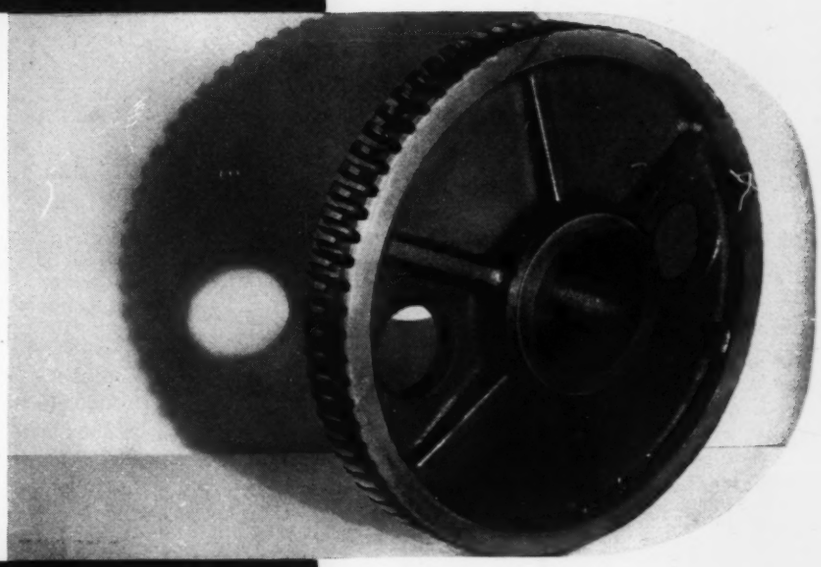
The author points out that a fairly complete discussion of the subject requires mention of disturbing mechanical agencies, perhaps the most important of which are the unbalanced dynamic forces and couples associated with engines and locomotives. In the two chapters covering these questions the author enunciates and employs Lagrange's equations, partly because of their fitness and utility and partly as an introduction to the idea of generalized co-ordinates

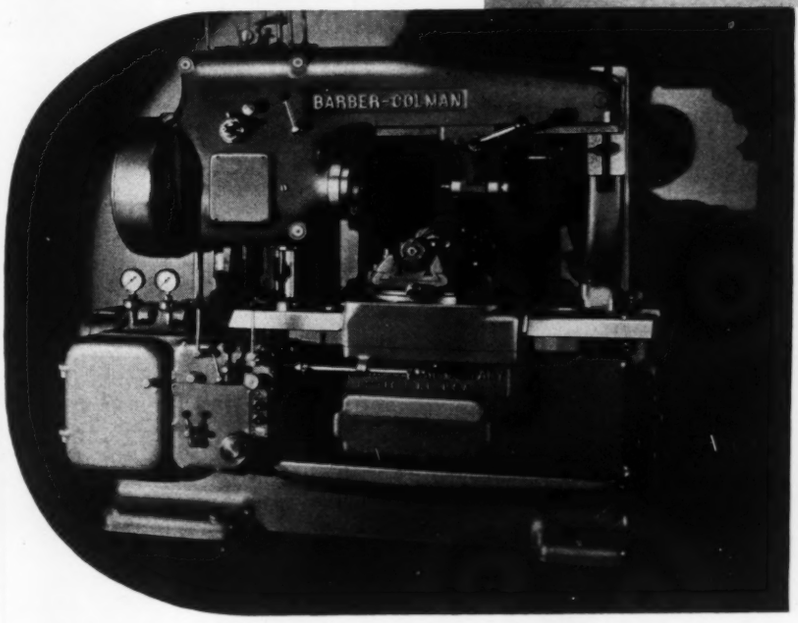
NICKEL
CAST IRONS

FOR GEARS THAT WEAR BETTER AND LAST LONGER

HIGH CARBON,

Nickel alloy, electric furnace cast iron compositions recently developed by Frank Foundries, Moline, Ill., meet all basic requirements for improved gear materials including good strength, ready machinability and wear resistance. Pictured at right is a hobbing machine gear produced from one of these special Nickel-chromium-molybdenum cast irons whose tensile strength is in excess of 40,000 lbs. per square inch and whose Brinell Hardness is approximately 240 in 1.2" sections. These alloy cast irons possess structural characteristics which assure a high degree of wear resistance combined with other properties essential to improved gear performance.





EFFECTIVE LUBRICATION

in this Barber-Colman hydraulic hobbing machine is assured by a combination of good design and the selection of suitable materials. High carbon Nickel Cast iron gears are structurally designed to assist in full lubrication and accordingly to reduce gear wear and assure quiet and satisfactory operation of a unit. Adding Nickel to cast iron induces dense grain in gear castings and markedly increases their resistance to wear.

• • •

NEW GEAR BOOK—

Write for your copy of our new publication "Modern Trends in Nickel Steel and Cast Iron Gear Materials". Available free on request.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

THE New York, Susquehanna & Western Railroad recently placed two of these new, 80-passenger, self-propelled railcars in commutation service. Under the floor, a 290 hp. engine is mounted and the power is supplied direct to the axle through a Twin Disc Hydraulic Torque Converter.

ADVANTAGES: The Twin Disc Hydraulic Torque Converter makes the compact, light weight power plant practical because it greatly increases the engine's torque, eliminating starting jars and jerks and assuring a smooth, easy roll from a standing start . . . quick acceleration and a rapid, effortless shift into direct drive for the top speed.

Twin Disc Torque Converters lend themselves to the widest variety of heavy-duty industrial applications . . . locomotive cranes, hoists, oil well drilling rigs, logging donkeys and yarders. For complete description, ask for Bulletin No. 119.

involved in the more advanced theory of the following chapter.

□ □ □

Standard Metal Directory

Published by Atlas Publishing Co., New York; 610 pages, 6 by 9 inches, cloth bound; available through MACHINE DESIGN *for* $10 *postpaid.*

Tenth edition of this directory includes descriptive lists of iron and steel plants, foundries, metal rolling mills and metal smelters and refiners. In addition the contents are broken down into more detailed categories such as aluminum foundries, battery manufacturers, copper smelting works, exporters of scrap metals, pipes and tubes, etc. Plants are arranged alphabetically by states. The book is comprehensive and useful for buyers or marketers.

□ □ □

Handbook of English in Engineering Usage

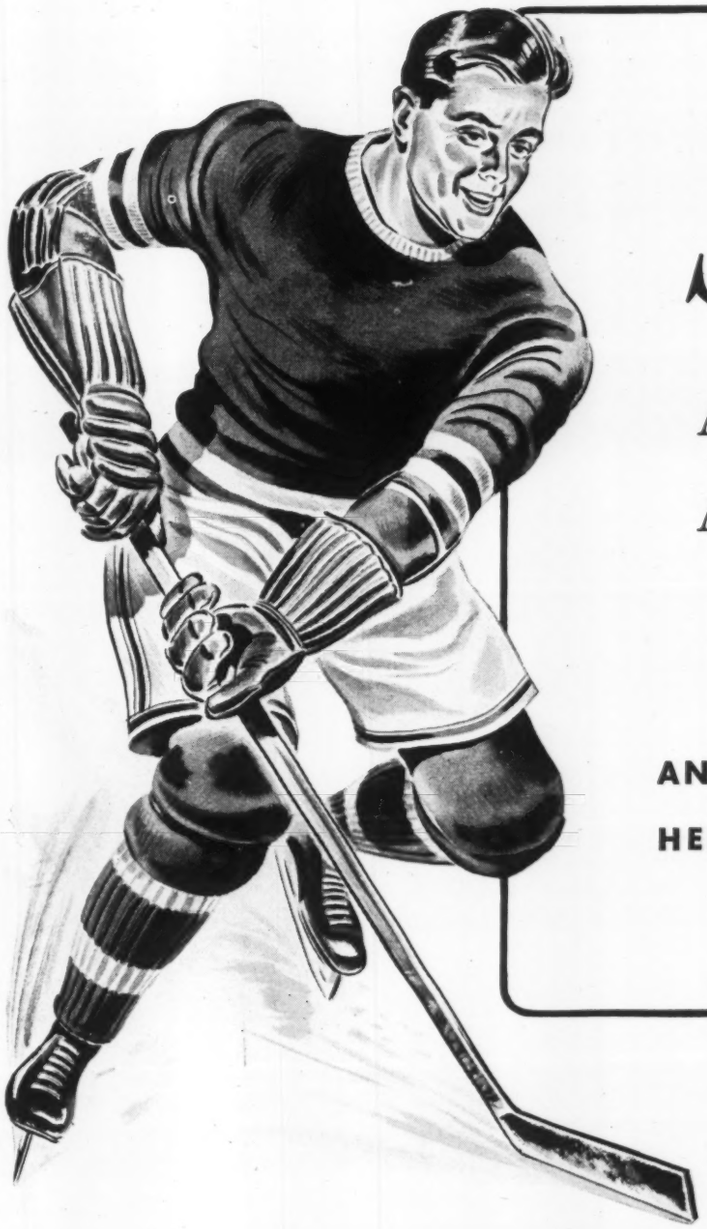
By A. C. Howell; published by John Wiley & Sons Inc., New York; 433 pages, 5 by 7¼ inches, cloth bound; available through MACHINE DESIGN *for* $2.50 *postpaid.*

In a letter to the author of this book, now in its second edition, C. F. Kettering presented as cogent a reason as possible for the existence of such a volume. He said, in part, "Success in engineering and research depends as much upon the ability to present ideas convincingly as it does upon the ability to perform calculations and experiments." Accordingly, the book was written "to serve as a guide for the engineer who wishes to make his English clear, accurate and concise."

In the ten years since the first edition of the book was published changes in technical writing style have brought about a need for revision of the volume. To illustrate these changes the author has included a large number of illustrations of the best engineering writing, taken almost invariably from published material.

Actually, the material covered is that usually presented in required English courses in engineering schools, but it is perhaps more useful and forceful because of its singleness of purpose. After all, "engineering" English is basically no different from the ordinary variety. Sections of most value are likely to be those discussing the business letter, technical reports, and technical magazine articles.

Let me mention one gift which, next to the prerequisite of confidence in their work, I wish on all young designers in the field, and that is a healthy amount of skepticism as to the success of their machines and ideas at least until the results are shown on the employers' balance sheet.—Wm. Vutz in *Agricultural Engineering.*



Speed—

AS MUCH OR AS LITTLE AS YOU NEED

•

AN ADVANTAGE OF A-E-CO HELE-SHAW FLUID POWER

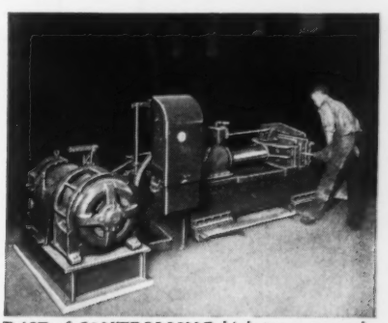
IF you've ever compared the speed of a hydraulically driven face grinder table, taking a light finishing cut, with the movement of a slowly closing, hydraulically operated press, then you will know what Hele-Shaw Fluid Power is capable of in speed variation.

With Fluid Power you can race . . . or creep so slowly that movement of the driven mechanism is unnoticeable.

You can select *any* speed within the limits of the Hele-Shaw Pump by simply pulling a lever or turning a wheel. It's that easy. Speed variation is important although it is only one of many benefits of Fluid Power operation.

Here's pressure—up to 3000 pounds per square inch . . . sensitive control of movements of heavy machine parts, mechanical simplicity, dependability, ease of application, manual or automatic control over one or over many steps in a complete cycle of operation.

And you're likely to find Fluid Power saves operating and maintenance costs.



EASE of CONTROLLING high pressures makes fluid power ideal for bulldozers. The Hele-Shaw Pump may be adjusted for a wide variation in strokes per minute.

We haven't told you the whole story because that would require much more space than this page. We'll continue when we've heard your problem. Call us up or drop us a line and we'll be glad to help you to build-in or design-in Hele-Shaw Fluid Power (oil under pressure for driving machines).

A-E-CO HELE-SHAW *Fluid* POWER

AMERICAN ENGINEERING COMPANY

2502 ARAMINGO AVENUE, PHILADELPHIA, PA.

Other A-E-CO Products: Lo-Hed Hoists, Taylor Stokers, Marine Deck Auxiliaries.

Whether you work with pencil or ink or both, Arkwright Pencil Tracing Cloth and Matsurf will give you sharp, clear, *permanent* drawings. Both these tracing cloths have a "tooth" that gives smooth, clean pencil lines. Both take ink swiftly, freely, without "feathering."

Arkwright Pencil Tracing Cloth can be used on both sides. Matsurf, slightly more transparent, has one dull side for drawing, a glossy side that keeps the tracing clean. Both Matsurf and Arkwright Pencil Cloths are given a permanent "parchment" finish. Will not become brittle or opaque with age.

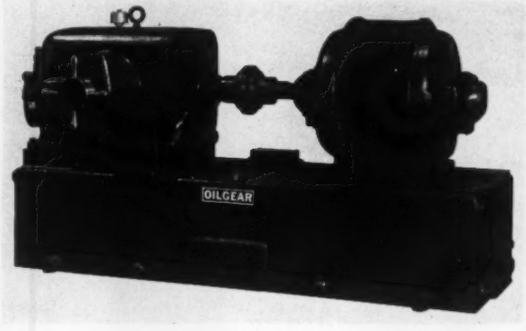
Specify Arkwright or Matsurf the next time you buy tracing cloth. You'll get better blue prints – and you'll get *permanent* protection for your important drawings!

Arkwright
FINISHING COMPANY
Providence Rhode Island

New PARTS AND MATERIALS

Offer Variable Displacement Pumps

TWO-WAY, three-position, electric controlled variable displacement pumps are now being manufactured in conventional sizes from 2 to 150-horsepower by the Oilgear Co., West Bruce street, Milwaukee. Each size pump is available with internal pumping mechanisms for normal working pressure ratings of 1100, 1700 and 2500 pounds per square inch and for peak pressures up to 3000 pounds per square inch. All pumps are arranged for flanged mounting to a separate reservoir base, or reservoir integral with the machine. Other features include: Built-in auxiliary gear



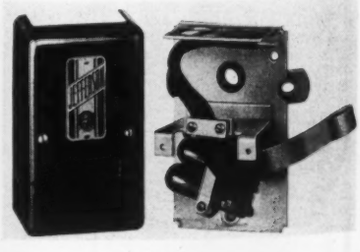
Line of electric controlled variable displacement pumps has auxiliary gear pumps for super-charging the high pressure unit

pumps for super-charging the high pressure unit, for operating the pump control mechanism and for auxiliary purposes; a built-in relief valve for the gear pump; dual built-in reverse flow high pressure adjustable relief valves which protect the machine and pump against overload; two-way automatic suction and discharge valve flanged integral with the pump case.

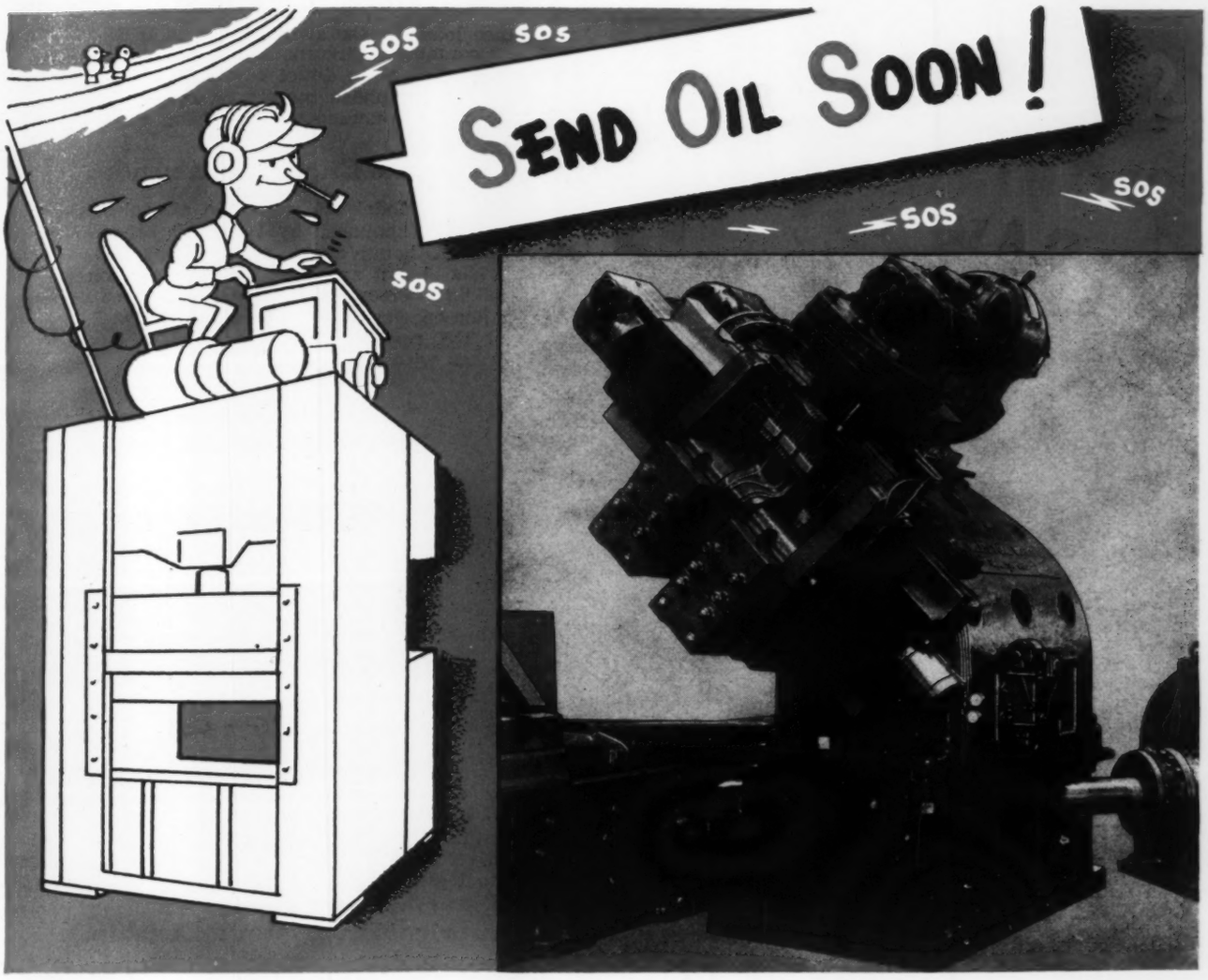
Control Switch Added to Line

AN all-round control switch in which the circuit is made and broken inside ferro-tube mercury contacts has been added to the line made by Jefferson Electric Co., Bellwood, Ill. The switch can be furnished

Circuit is made and broken inside ferro-tube mercury contacts in control switches



with one mercury contact for single pole or a pair of contacts may be used for two-pole make and break. The



When bearings call for help, they are about to go up! And—when but one bearing goes *up*, production will go *down!*

No bearings on the machines you build will call for help when served by a Farval Centralized System of Lubrication—because with Farval each bearing gets the proper amount of lubricant at all times and—not a bearing is missed.

The Farval System is a positive, mechanical method of delivering lubricant, under high pressure, from a central station, to a group of bearings in exact measured quantities and as frequently as desired.

Why not protect your customers' production schedules by installing Farval on the machines they buy, *before* you ship? *Send* for a Farval System before the user *spends* its equivalent on repairs and maintenance expense. We can *Send One Soon!*

Special Delivery TO EVERY BEARING

The Farval Corporation, 3265 East 80th Street, Cleveland, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Manufacturers of Automotive and Industrial Worm Gearing

In Canada: PEACOCK BROTHERS LIMITED

FARVAL

CENTRALIZED SYSTEMS OF LUBRICATION

SUCCESS STORY

SAW BREAKAGE *Drastically Reduced*

Sales, customer good-will and profits jumped when a smart band saw manufacturer tried Ampco Metal for troublesome saw guides. Hardened steel had been galling and sticking, causing excessive breakage of blades. AMPCO METAL reduced breakage drastically and improved performance.

How Can AMPCO METAL Serve You?

Are there places in either your product or your production tools where *metal failure* is causing trouble? If so, AMPCO METAL can help you . . . as it has helped an impressive number of prominent manufacturers. There's no other bronze like it. AMPCO METAL is unequalled in its resistance to wear, impact, fatigue, and corrosion. It can be supplied in a wide range of properties and forms.

AMPCO METAL, INC.
Dept. MD-9
MILWAUKEE, WIS.

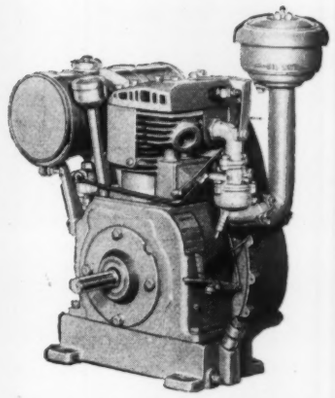
WRITE FOR DATA

Tell us what you're up against, and we'll send complete data sheets and recommendations.

resistance load for the switch is up to 1875 watts per mercury contact on circuits up to 440 volts alternating current and 250 volts direct current, for use with ¼-horsepower split phase motors, ½-horsepower capacitor motors and ¾-horsepower repulsion motors.

Gasoline Engine Announced

KNOWN as Model ZZ, a 4-cycle aircooled gasoline engine is announced by Briggs & Stratton Corp., Milwaukee. Although rated at 6 horsepower, the engine in tests has shown an actual output at recommended speeds of 6.15 horsepower at 2200 revolutions per minute, 7.2 horsepower at 2700 revolutions and 7.7 horsepower at 3200 revolutions. Piston displacement is 22.97 cubic inches with a 3 by 3¼-inch bore and stroke. A



Output horsepower of aircooled gasoline engines is considerably greater than rated horsepower

specially designed dust and moistureproof flywheel magneto supplies ignition. Model ZZ is also available in variations incorporating base, crankcase, blower housing, etc., of cast aluminum instead of cast iron, with 6 to 1 gear reduction drive, or direct mounting.

Lubrication System Developed

AN OIL lubrication system has been developed by U. S. Electrical Motors Inc., Dept. 77, 80 Thirty-fourth street, Brooklyn, N. Y., which is now being supplied on all open type SA and Uniclosed type SC motors larger than 30-horsepower, 3600 revolutions per minute, and 75-horsepower, 1800 revolutions per minute. A conveniently located oil gage is supplied.

Starters Need No Resetting

FOR starting, stopping and overload protection of single and polyphase motors up to 7½-horsepower, new across-the-line manual motor starters are announced by the Electrical division, Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. Feature is the auto-

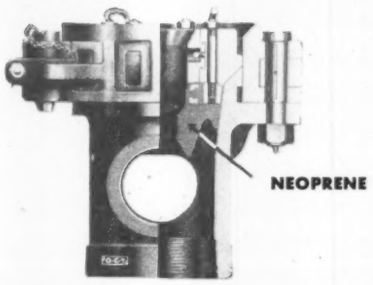
Automatic relatching mechanism in manual motor starters eliminates any resetting operation

matic relatching mechanism which eliminates any resetting operation as there is no intermediate or tripped position of the starter handle. An excessive overload

THE STORY OF THE

Tubing Stripper's Throat

(and how NEOPRENE keeps it "swallowing!")



"THIS TUBING STRIPPER is going to have a sore throat," said an oil field equipment manufacturer to his rubber supply salesman, "unless we can find the right resilient material for it."

"The more I think about it," said the supplier, "the more it sounds like a job for Du Pont neoprene." Why neoprene? Well—a tubing stripper's job is not exactly an easy one. Through its "throat" would run mile after mile of oil well tubing as it went down into the well. A tough material was essential to withstand this abrasive friction. But, at the same time, it would have to be resilient enough to allow pipe collars on the tubing to slip through. And all this abrasion would be in the presence of oil and gas under tremendous pressure!

The supplier knew of neoprene's reputation—that it has all the strength, resilience and toughness of natural rubber . . . *plus* resistance to oil, heat, gasoline, oxidation, aging and corrosive acids and gases. So he resolved to put this remarkable chemical rubber to the test.

Equipped with a neoprene "throat," approximately five miles of tubing were run through the stripper in the presence of oil and gas. The test showed conclusively that the efficiency of the neoprene part had not been affected in the slightest degree.

But sometimes a laboratory test is not an accurate barometer of real service conditions. So the neoprene-equipped tubing stripper was checked carefully when it first was introduced into the field. Results were even more satisfying. In one case a stripper "swallowed" about 40,000 feet of tubing, after washing in six wells, varying in depth from 6500 to 7700 feet. In spite of this bruising wear and the weakening effects of the oil and gas, the neoprene part was still in perfect working condition!

Every year more and more manufacturers are finding out just how valuable this tough, oil-resistant chemical rubber can be. Neoprene has solved countless production and design problems. Perhaps it can solve yours. Write for the interesting "Neoprene Notebook"—it's packed with practical and profitable uses for neoprene. E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division, Wilmington, Delaware.

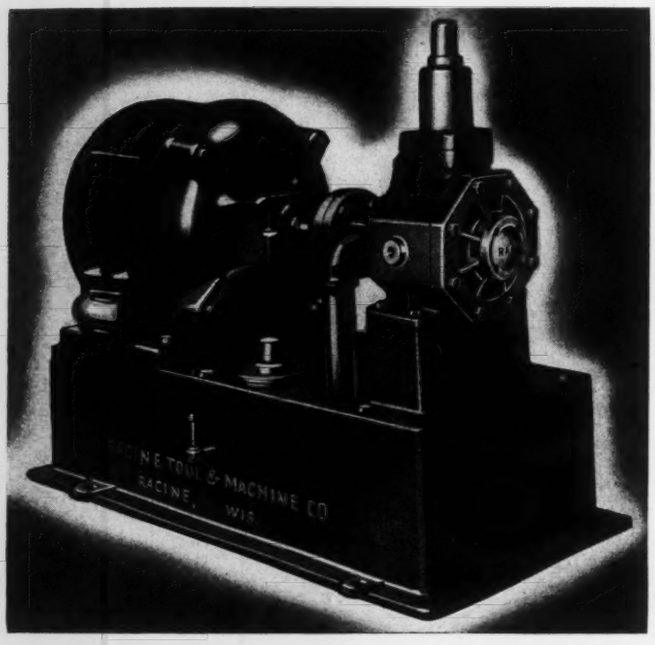
. . .

BE SURE TO SEE OUR EXHIBIT AT THE NATIONAL METAL EXPOSITION, CLEVELAND, OCTOBER 21-29

DU PONT

NEOPRENE

the chemical rubber



New VARIABLE VOLUME HYDRAULIC PUMPS

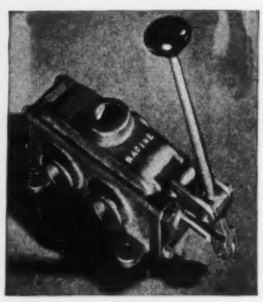
RACINE announces its new 1000# Variable Volume Pump. Advanced in design and construction, it incorporates the special advantages of smooth, quiet operation—needle roller bearings—mechanical seals. An exclusive method keeps vanes hydraulically balanced. Hydraulic governor automatically maintains desired pressure without by-passing of oil.

Capacities—12—20—30 gallons per minute
Variable Pressures—Up to 1000 lbs. per sq. in.
Mountings—Foot or flanged type

Let our engineers help you with your hydraulic problems; send for literature today.

RACINE HYDRAULIC VALVES

Engineers and designers you are offered a complete service for oil hydraulic systems—Variable Volume pumps—Feed controls—Pressure regulators. A complete line of hydraulic valves—Manual—Pilot—or Electrically operated. Let RACINE assist you with your hydraulic problems.



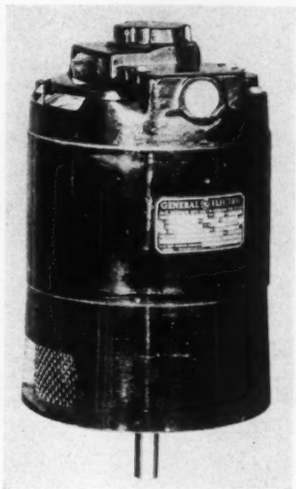
RACINE TOOL & MACHINE COMPANY
1773 STATE ST. RACINE, WISCONSIN

RACINE

will open the circuit even though the handle is intentionally held in the "on" position. The quick-break positive toggle mechanism is so designed that vibration or shock will not cause contacts to open and it is mechanically impossible for contacts to close until the start button has been pressed.

Jet Pump Motor Is Ventilated

DESIGNED for through ventilation, a fractional horsepower capacitor motor for jet pumps has been announced by General Electric Co., Schenectady. Available in sizes from 1/6 to 1-horsepower at 3450 revolutions per minute, this motor has openings in the pulley-end end shield to permit cool air to be forced through the stator. Smoother lines are given the unit by its built-in capacitor in the end shield. Thermal overload protection is provided by an overload switch mounted in the end shield.



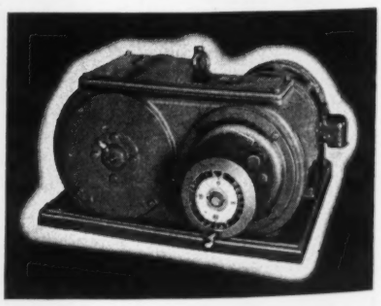
Motor has opening in pulley-end end shield to permit cool air to be forced through stator

Outlet Supports, Connects Clocks

PROVIDING both mechanical support and electrical connection for clocks, etc., a special electric outlet is announced by the appliance and merchandise department of the General Electric Co., Bridgeport, Conn. It includes a brass plate with a hook which is an integral part of the plate. The outlet itself is deeply recessed to conceal the cord and plug and allows the clock to hang flush with the wall. It is rated 10 amperes, 250 volts, and 15 amperes, 125 volts.

Speed Indicator Improved

AN IMPROVED handwheel-speed indicator for use with the Reeves variable speed transmission, Varispeed rotor pulley and Motodrive is announced by Reeves Pulley Co., Columbus, Ind. Known as the Speedial, this indicator accurately shows speed settings

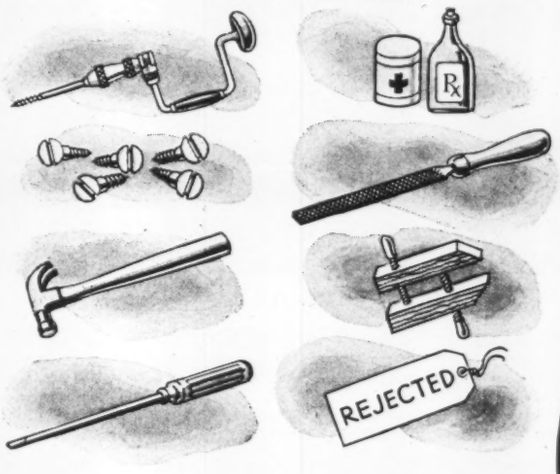


Handwheel speed indicator shows speed settings as governed by definite number of turns of screw

HERE'S YOUR EVIDENCE

WHY

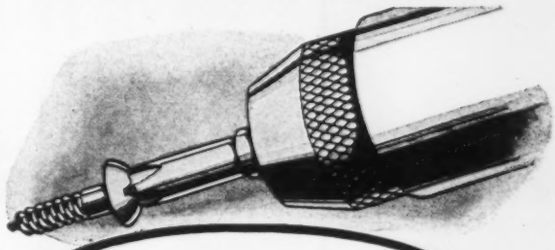
DRIVING OLD-FASHIONED SCREWS WASTES TIME.



Twice as many hands are needed with old-fashioned screw driving as with **PHILLIPS RECESSED HEAD SCREW** *shown at right.*

WHY

PHILLIPS SCREWS SAVE AN AVERAGE OF 50% IN ASSEMBLY TIME.



Every item pictured left represents unnecessarily wasted time — hours which *can* be saved using Phillips Screws.

Phillips Screws shorten hours spent in screw driving, and speed delivery of your products by eliminating:

need for drilling pilot holes
need for a helper to steady the work
slow driving with hand drivers
crooked screws or split heads
accidents caused by slipping drivers
delays caused by broken drivers
refinishing screw driver scars

The Phillips Screw clings to the driver, permitting one-hand driving while the other hand holds the work. The recess prevents the driver from slipping, so it's safe to use a faster driving method. Fewer screws (or smaller, lower-cost sizes) can be used because the Phillips Screw provides greater holding power.

The reason you see Phillips Screws on most makes of cars, aircraft, electrical appliances, furniture, etc. — is that those manufacturers have proved it costs less — in time and money — to use Phillips Screws. Don't let slow-poke fastening cause an unnecessary jam of unfilled orders. Get in touch with one of the firms listed below.

PHILLIPS RECESSED HEAD SCREWS...

MACHINE SCREWS SHEET METAL SCREWS WOOD SCREWS STOVE BOLTS

Speed Product Deliveries by Cutting Assembly Time

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

American Screw Co., Licensor, Providence, R.I.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corporation, New Britain, Conn.

The Lamson & Sessions Co., Cleveland, Ohio
National Screw & Mfg. Co., Cleveland, Ohio
Parker-Kalon Corporation, New York, N.Y.

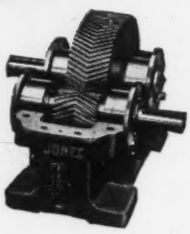
Phoenix Manufacturing Company, Chicago, Illinois
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N.Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago, Ill.

SINGLE! DOUBLE! TRIPLE!

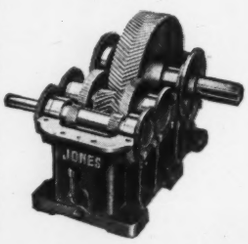
—every type of
Herringbone Speed Reducer
that you might need

JONES Herringbone Gear Speed Reducers are built in a wide range of ratios and ratings to cover every requirement. Single (Type SH) reducers in standard ratios range from 1.25 to 1 up to 11 to 1 in ratings from 1.3 to 440 H.P. Double (Type DH) reducers are built in standard ratios from 10.9 to 1 up to 72 to 1 in ratings from 0.5 to 275 H.P. The triple reduction reducers (Type TH) cover a range of ratios from 86.9 to 1 up to 355.8 to 1 in ratings from 0.3 to 78 H.P.

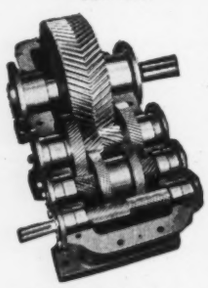
All these reducers have heat treated gears, ground shafts and are mounted with anti-friction bearings throughout. Cast iron bases are available for all variations of motor assembly. Liberal stocks are carried to facilitate shipments.



Single Reduction
Type SH

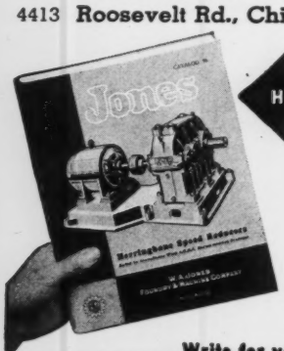


Double Reduction
Type DH



Triple Reduction
Type TH

W. A. JONES FOUNDRY & MACHINE CO.
4413 Roosevelt Rd., Chicago, Ill.



HERE'S THE LATEST INFORMATION
about the application of Herringbone Reducers

This new 128-page catalog of Jones Herringbone Reducers presents a vast amount of data relating to Herringbone Reduction Units. Illustrations show a broad range of herringbone reducer applications and the technical information shows how to select reducers for all conditions of service in accordance with the A.G.M.A. recommended practice.

Write for your free copy of this valuable treatise

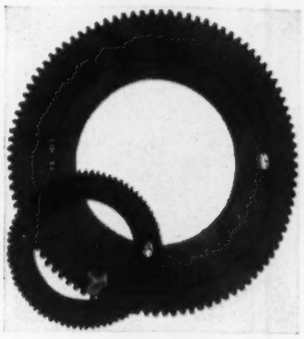
Since 1890
Jones

HERRINGBONE -- WORM — SPUR — GEAR SPEED REDUCERS
CUT AND MOLDED TOOTH GEARS — V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS — PULLEYS
FRICTION CLUTCHES AND TRANSMISSION APPLIANCES

of the different units and the actual indication is a definite number of turns of the speed shifting screw. For each full turn the Speedial registers one point or degree on the circular scale. Space is also available on the dial for calibrating to suit individual requirements. Gear ratios of 20, 30 and 60 to 1 are available.

Gear Teeth Integral with Clutch Facings

HEAVY duty clutch facings with integrally molded gear teeth are announced by the Gatke Corp., Chicago. The teeth are molded the full thickness of the facing, increasing the wear area and eliminating wear on the housing. Molded asbestos material is used, combining great strength and heat conductivity with long life and powerful, smooth action at all operating temperatures. These facings are furnished in all sizes up to 30-inch diameter.



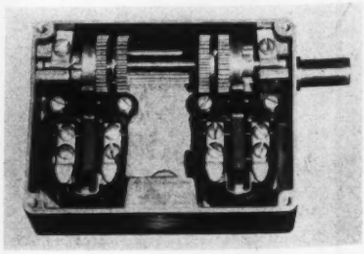
Teeth of heavy duty clutch facings are molded the full thickness of the facing, increasing wear area

Molding Compounds Are Arc-Resistant

FORMULATED specifically to prevent tracking where there is combined electrical spark and rubbing action, a new arc-resistant phenolic molding compound called Durez 8685 is announced by Durez Plastics & Chemicals Inc., North Tonawanda, N. Y. While slightly slower to cure in the mold, its electrical properties are materially increased by baking after molding. It will also hold its high dielectric strength when used at moderately high temperatures. Durez 8685 is more flexible in its final set than standard materials and does not crack under the expansion and contraction of metal inserts around which it may be molded.

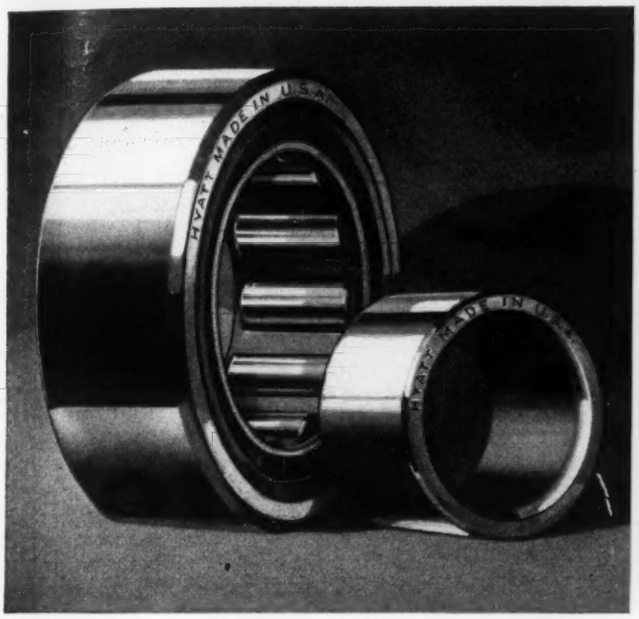
Switch Limits Shaft Rotation

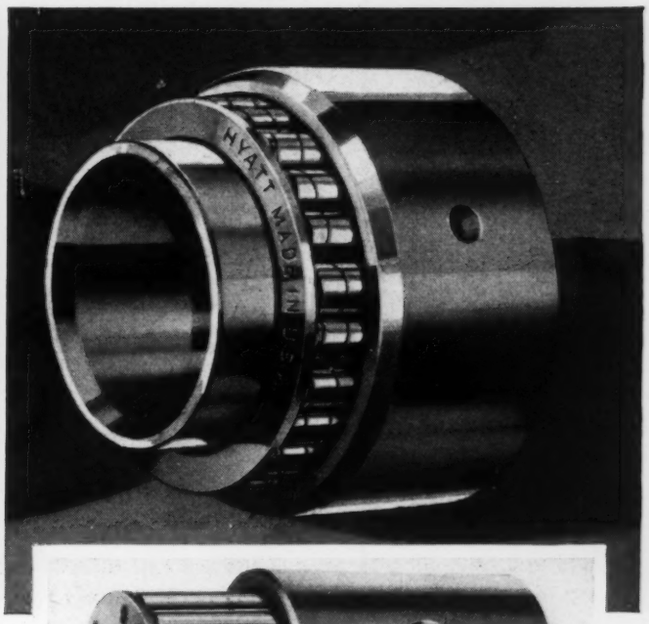
FOR application on motor-driven devices where it is necessary to limit the rotation of the motor shaft or some rotating shaft or gear on the driven machine, a small-size geared-type limit switch is announced by General Electric Co., Schenectady. In use the shaft of the switch (which is usually direct connected to an electric motor) serves as a driving gear, causing the pinion shaft to turn. The pinion shaft engages the driving gears which move along the drive screw toward one of the operating gears at either end, depending on the way they are turned by rotation of the pinion shaft. At the end of travel in either direction a pin on the

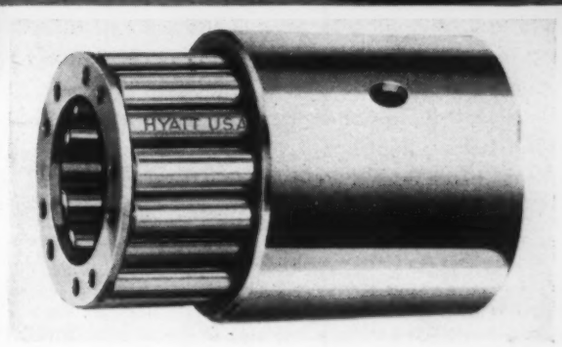


Shaft of geared type limit switch serves as driving gear, causing pinion shaft to turn

LIGHTENING THE LOAD







●No matter what the application there's a size and type of Hyatt Roller Bearing for the job. Illustrated above left, Hyatt Hy-Load Solid Roller Bearing; above right, Hyatt Wound Roller Type Bearing; opposite, 90,000 Series Solid Roller Bearing.

WITH SMOOTH-ROLLING HYATTS there's no friction to rob mechanical equipment of its ability to function well. Freed from friction, Hyatt-protected machinery takes all loads with a minimum of effort . . . with less wear and attention . . . and lasts longer. Tough jobs come easy wherever Hyatt Roller Bearings are used . . . in mill and factory, on highway, farm, and railway. Let Hyatts lighten the load of all your equipment. Hyatt Bearings Division, General Motors Sales Corporation, Harrison, New Jersey; Chicago, Detroit, Pittsburgh and San Francisco.

HYATT

ROLLER BEARINGS

QUIET

Let Bristos show how they can help you, too, make faster, stronger assemblies

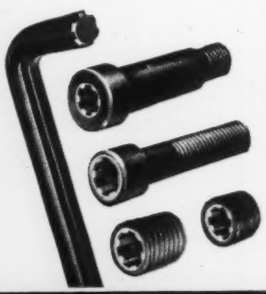
Would you be willing to gamble the price of a postage stamp to get the facts on a new kind of socket screw that users say speeds up assemblies, abolishes waste motion, saves time, trouble and money? Then mail in that handy coupon below. It brings you, free, a handful of super-strength Bristo Socket Screws for you to try out as you see fit.

ALL THESE ADVANTAGES!

You will see that the fluted socket grips the wrench with a non-slipping hold. More force can be exerted on the turn without danger of the wrench slipping or the socket shearing, stripping or rounding out. A Bristo can be set up tighter and will *stay* tighter even in severest service. In assembling your products, this means less time out for resetting. Work goes faster; easier, too.

BOTH WITHOUT COST

Mail the coupon today for these sample Bristo Socket Screws and your copy of Bulletin 83-8N. Both are yours without cost or obligation.



QUICK BRISTO FACTS

Lock-tight socket head,—won't split, shear, round out, jam or strip. Set tighter with less effort. No loosening under vibration. Take wrench without fumbling or skidding. **Designed by engineers for engineers.**

BRISTO
SOCKET SCREWS

THE BRISTOL COMPANY, Mill Supply Division
WATERBURY, CONN.

Send me sample Bristo Socket Screws in the following sizes_____
(State Sizes)
Also send me Bulletin 83-8N.

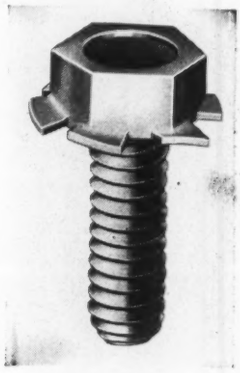
Name_____

Address_____

traveling gear engages a pin on the operating gear, causing the operating cam and safety pin to rotate and move the switch contact arm to a high part of the cam, operating the contacts.

Lockwasher Integral with Screw

WITH the lockwasher part of the screw, new "Lock-Tite" screws are announced by Continental Screw Co., New Bedford, Mass. For metal-to-metal fastening, this screw embodies in one unit the advantages of separate lockwasher and screw assemblies, but has the added advantage of eliminating lost time in putting



For metal-to-metal fastening, screw has lockwasher as integral part

washers on screws and preventing lost washers. It drives like an ordinary screw. Made to meet specific needs, these fastenings may be varied in regard to washer teeth, material, hardening and tempering to obtain most suitable locking or binding conditions required.

Oiler Operates without Flooding

A VISIBLE, unbreakable loose pulley oiler for slow and high speed applications without flooding is announced by the Trico Fuse Mfg. Co., 2948 North Fifth street, Milwaukee. Three distinct principles of operation are employed—thermal, capillary and gravity action. The copper tube transmits the heat of the pulley hub to the oil reservoir to produce quick thermal action.

Thermal, capillary and gravity action principles are utilized in visible, unbreakable loose pulley oiler

Oil is fed by the wire-reinforced wick through capillary action, and it is dropped on the bearing by gravity. No attention is required except occasional refilling of the reservoir. This oiler is available in one and two-ounce capacities and comes with ⅛ or ¼-inch pipe thread fittings.

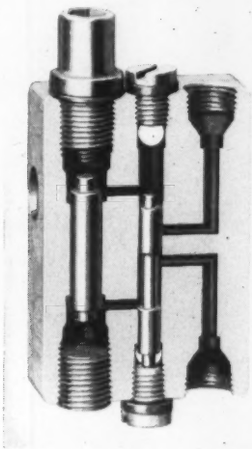
Wing Nut Line Extended

THE line of one-piece stamped wing nuts made by Central Screw Co., Dept. 59, 3523 Shields avenue, Chicago, has been expanded. Three new types are announced as available. Type 16 is a central wing nut with special low wings; type 3 is a standard pattern central wing nut; and type 10 is a broad base central

wing nut, especially designed to eliminate the need for a washer. Its rounded edge eliminates scoring caused by heavy pressure or changed position. All types are available in plain bright finish or plated to meet any particular demand.

Reduces Size of Lubricating System

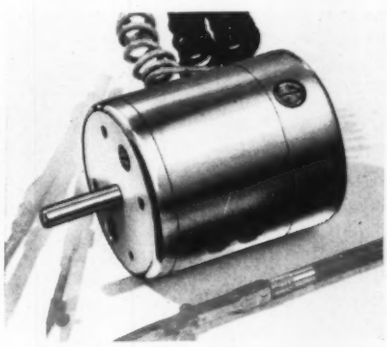
OPERATING on the same piston displacement principle of measurement employed in large Dualine systems on heavy machines, a Dualine Jr. centralized lubrication system is announced by Farval Corp., Cleveland. Its size has been greatly reduced to provide correct application to small machine tools and other equipment. The sectional view shows the valve block actual size. Without check valves or springs, Dualine Jr. has only two moving parts, and lubricant is delivered positively to all bearings. A corresponding line of fittings, hose, couplings and other accessories is available for use with this system.



Providing correct application to small machines, smaller centralized lubrication system operates on piston displacement principle

Small Motor Suited to Aircraft

SMALL size motor designed by Eicor Inc., 515 South Laflin street, Chicago, weighs 1½ pounds and delivers 1/13-horsepower at 8500 revolutions per minute. It is particularly suited to aircraft service, for band-switching, antenna reels or any type of remote control. The unit is 2-5/16-inch in diameter and 2¾-inches long.



Small motor is particularly suited to aircraft service such as band-switching or antenna reels

Locknut Permits Shorter Bolts

PROVIDING a method for increasing the thread area in sheet metal, Fast-On locknuts are announced by Fabri-Steel Products Inc., Kerr Machinery building, Detroit. The small square portion of the nut is inserted in the square hole previously cut in the metal, protruding just enough for the four corners to be

Clean Cut Castings of ABSCO MEEHANITE

Final clean-up on ABSCO Meehanite machine base castings, shipped unfinished.

. . . Simplify Assembly Problems

Careful workmanship and rigid inspection of ABSCO Meehanite castings extend from the pattern shop to the finishing department. When you order ABSCO Meehanite castings singly or for production parts you can be sure of accuracy throughout.

For full particulars write to Department D

SELECTIVE PROCESSING provides ABSCO Meehanite with the combination of these qualities that fits your needs

1. *Combined strength and toughness*
2. *Acid and corrosion resistance*
3. *Abrasion and erosion resistance*
4. *Pressure tightness*
5. *Ability to stand shock and strain*
6. *Intense hardness through chilling or heat treatment*

THE AMERICAN BRAKE SHOE AND FOUNDRY COMPANY

BRAKE SHOE AND CASTINGS DIVISION

FOUNDRY MAHWAH NEW JERSEY

OFFICES 230 Park Avenue, New York, N. Y. 332 South Michigan Ave., Chicago, Ill.

UNEQUALLED CHECK-UPS

eliminate the "Doubtful Few"

Some of the scientific check-ups in the 16-Point Quality-Control routine.

. . . when Parker-Kalon's Quality-Control Laboratory backs your fastening devices

You get an unequalled protection against time-wasting, cost-boosting "duds" among your fastening devices when you specify Parker-Kalon! For, in Parker-Kalon's plant, an unusual Quality-Control Laboratory stands guard over all production, to eliminate the "doubtful few" screws that slow-up assembly work and produce unsatisfactory fastenings.

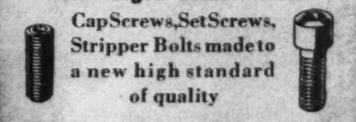
Without counterpart in the industry, this scientific Laboratory sets standards of quality that could never be maintained without rigid quality-control of every production step from chemical analysis of the metal to micrometric check-up of finished dimensions. It insures that every Parker-Kalon Fastening Device is more than "good enough" in both accuracy and strength.

Take no chances in your assembly jobs . . . buy Hardened Self-tapping Screws, Socket Screws or other fastening devices that are made in the screw industry's most modern plant. Parker-Kalon Corporation, 192-200 Varick Street, New York.

COSTS NO MORE *to get this Parker-Kalon Quality-Control Guarantee with every box of . . . .*

Hardened Self-tapping Screws
Types, sizes, head-styles for every assembly of metal or plastics

Cold-forged Socket Screws



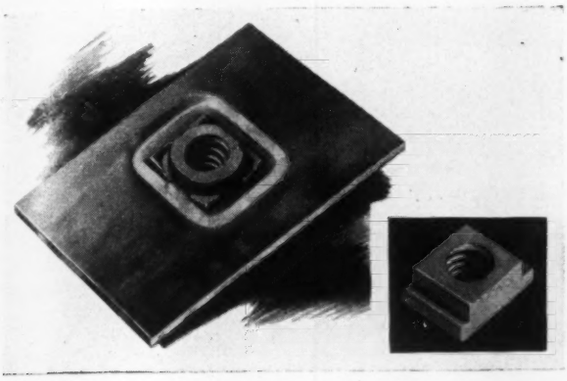
Cap Screws, Set Screws, Stripper Bolts made to a new high standard of quality

Wing Nuts-Cap Nuts-Thumb Screws
Cold-forged . . Neater, Stronger

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

Quality-Controlled **PARKER-KALON Fastening Devices**

clinched. Before and after application views are shown in the photograph. Variation in the thickness of the metal is automatically compensated for and

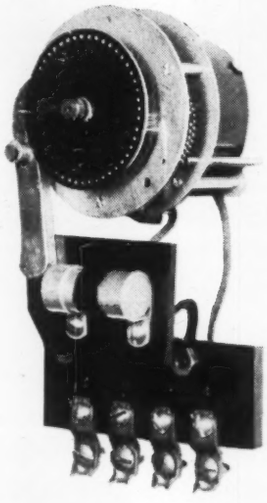


Thread runs to edge of new locknuts, permitting use with shorter screws and closer clearances

the thread runs to the edge of the nut, making practical its use with shorter screws and closer clearances.

Automatic Timer Announced

UTILIZING a clock movement, mercury contacts and one moving part, an automatic time switch is announced by Emra D. Bacon, 4513 Brooklyn avenue, Cleveland. A self-starting motor running in oil is used in the clock movement and contacts are the mercury-to-



Plainly marked dial of automatic time switch can be set for any practical number of time periods

mercury type enclosed in unbreakable metal tubes, eliminating arcing, burning, sticking and breakage. The plainly-marked dial can be set for any practical number of time periods.

Receptacles Specially Polarized

A SERIES of specially polarized compact three-pole plugs and receptacles particularly suitable for use on electrical and electronic devices is announced by the American Phenolic Corp., 1250 Van Buren street, Chicago. Unique basic design permits mounting both plugs and receptacles direct to sheet metal panels with a spring steel retainer ring as illustrated, or by means of a riveting plate. Other methods involve mounting shells, or use of plugs as cable connectors with indestructible drawn steel caps equipped either with ends

O.Z. COUNTS ON P-K FOR THE "SQUEEZE"

AVOIDS "DOUBTFUL" SCREWS BY USING QUALITY-CONTROLLED PARKER-KALON SOCKET SCREWS

Great pressure is required in making this electrical connection permanently secure. It is no job for "doubtful" socket head cap screws. That's why O. Z. Electrical Mfg. Co., Inc. specifies PARKER-KALON and says: "The exceptionally high tensile strength more than meets our unusual requirements . . . tremendous pressure does not damage the socket . . . unvarying uniformity of dimension satisfies our own close tolerances."

Every manufacturer who seeks maximum protection against the troubles which may be caused by a few "doubtful" – imperfect – screws in a lot, is sure to be interested in the unique Quality-Control routine under which Parker-Kalon Socket Screws are produced.

WRITE FOR FOLDER AND SAMPLES – read about this routine and the amazing Parker-Kalon Laboratory which makes it possible to maintain a new high standard of quality in socket screws. Free samples and local distributor's name will also be furnished. Parker-Kalon Corporation, 192-200 Varick St., New York, N. Y.

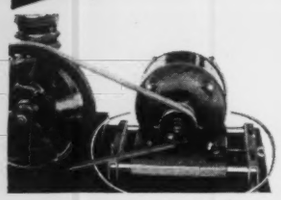
Quality-Controlled

16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.

PARKER-KALON
COLD-FORGED
Socket Screws

IMPROVE EQUIPMENT SPEED SALES with

New IDEAL "Automatic" Tension Motor Base

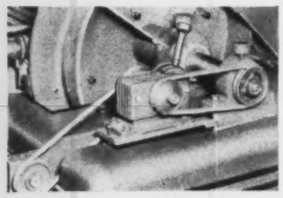


Practical, low cost **spring tension** motor base gives your products a new and potent appeal to buyers because—

1. Maintains correct belt tension
2. Saves Power
3. Increases Belt Life
4. Reduces Bearing Wear

Easy to install—Makes **short center drives** satisfactory. Mounts in any position—operates in any direction.

IDEAL "SELECT-O-SPEED" Transmission



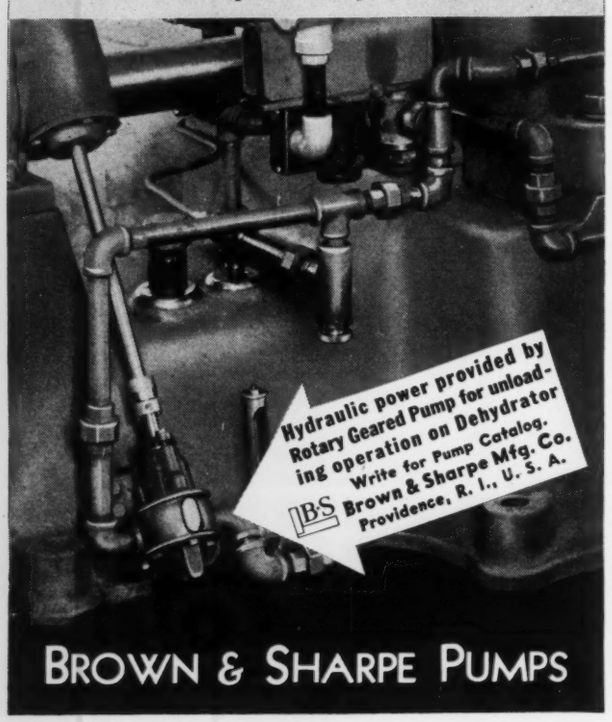
Low cost variable speed transmission. Gives your machines a new, powerful selling argument.

Features include: Infinite selection of speeds over a 5 to 1 range (higher ratios available); simple, rugged (all steel) construction; sizes from fractional to 7½ H.P.; standard "V"-Belts used.

ASK FOR FREE DEMONSTRATION
Transmission Division

IDEAL COMMUTATOR DRESSER COMPANY
1059 Park Avenue **Sycamore, Illinois**
In Canada: IRVING SMITH, Ltd., Montreal, Quebec

Flexibility **of Hydraulic Power —readily secured by installation of Brown & Sharpe Rotary Geared Pumps**

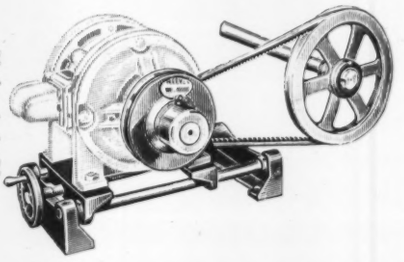

Hydraulic power provided by Rotary Geared Pump for unloading operation on Dehydrator
Write for Pump Catalog.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS

BROWN & SHARPE PUMPS

or side outlets, or with cable clamps. Bodies are molded of high-dielectric plastic, and receptacle contacts are phosphor bronze. Only 1¼-inch in outer diameter at the flange, this new No. 60 three-pole series fits in the same mountings as the standard two-pole series.

Motors Converted for Variable Speed

ADDITION of the Vari-Speed Jr. to its line is announced by Reeves Pulley Co., Columbus, Ind. Any standard constant speed motor of from fractional to 1½-horsepower may be easily converted into a variable speed unit, without special shaft extension. The Vari-Speed Jr. comprises a disk assembly and adjustable motor base, the disk assembly consisting of two cone-shaped disks, (one stationary and one laterally adjustable) a self-adjusting tension spring, a spring adjust nut and cover. This assembly is applied direct

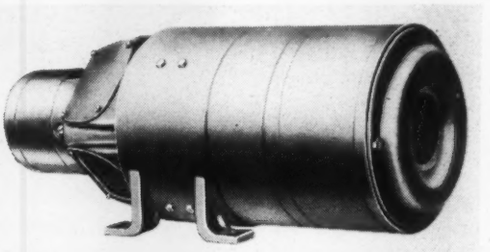


Disk assembly and adjustable motor base convert constant speed motor into variable speed unit

to the standard shaft extension of the motor and the motor is mounted on an adjustable base. The V-belt, driving between the two disks and the sheave pulley on the driven shaft, is a standard belt. By means of a handwheel the motor is moved forward and back, for maximum and minimum speeds respectively. Six sizes of disk assembly are offered.

Generator Voltage Control Is Unitary

AS A standard unit, a complete speed-variator equipment operating from an alternating current source to provide wide range of adjustable speed by means of the generator-voltage-control scheme is announced by General Electric Co., Schenectady, N. Y. Each unit consists of an adjustable-speed, direct-current motor, an adjustable-voltage motor-generator set with



Wide range of adjustable speed by means of generator-voltage-control is provided in standard unit

control and a separately mounted generator field rheostat. Standard speed ranges are available up to 16 to 1 ratio. The motor can be mounted directly on the driven machine, with speed changing control mounted near by. Units are designed to operate from 3-phase, 60-cycle, 220, 440 and 550-volt alternating current.

Announce High Frequency Capacitors

FOR high frequency service on induction furnaces and similar applications, a line of watercooled Inerteen capacitors is announced by Westinghouse Elec-

JOHNSON BRONZE

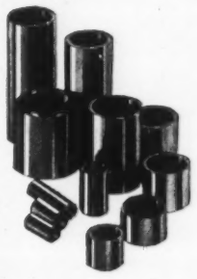
One DEPENDABLE SOURCE FOR *all* YOUR SLEEVE BEARINGS

Any Type . . . Any Size . . . Any Quantity

Ledaloyl

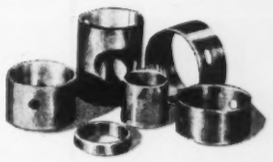
SELF-LUBRICATING

A new and unusual self-lubricating bearing. Contains LEAD, GRAPHITE and OIL — up to 35% by volume. An exclusive process of PRE-ALLOYING the basic materials guarantees uniform strength, uniform structure, even distribution of pores. Available from stock in over 300 standard sizes.



CAST BRONZE

Over 800 sizes carried in stock, in all principal cities for immediate service. Every bearing machine finished ready for assembly. Cast in S.A.E. 64. Specify Johnson General Purpose Bronze Bearings.



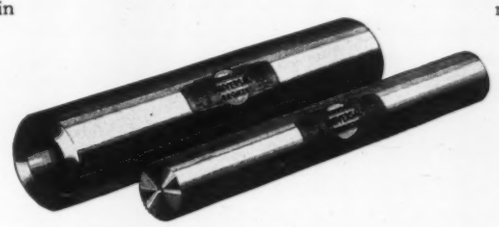
Steelbond

BRONZE-ON-STEEL

The strength of steel plus the bearing qualities of bronze — now combined in one bearing. Thoroughly tested, proved and adopted by many large users of sheet metal bearings. Sample bearings available for tests in your own plant. Try this new and unusual bearing.

BABBITT-LINED

Either bronze back or steel back. Available from stock or made to your specifications with any alloy of bronze and either tin or lead babbitt.



UNIVERSAL BRONZE BARS

Completely machined — I.D. — O.D. and Ends. Available from stocks in over 350 sizes Solid and Cored. Cast in S.A.E. 64. Carried in stock by leading Industrial Supply Distributors everywhere.

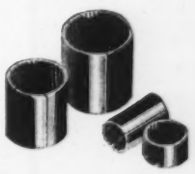
GRAPHITED

Plug type or serrated. Available in cast bronze or sheet metal bearings. Cast bronze graphited available from stock. Graphite is not soluble in water, gasoline or oil.

ELECTRIC MOTOR

Carried in stock for over 250 individual motors. Cast in a special high lead bronze to meet tough operating conditions. Every bearing machine finished, ready for assembly.

Write Today FOR COMPLETE CATALOGUE *Free!*



SHEET METAL

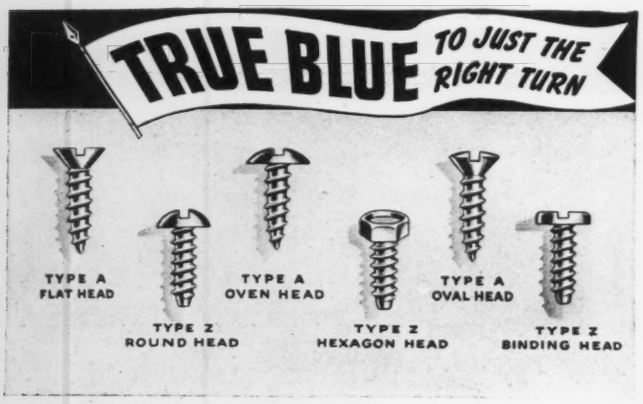
Thin wall bearings or bushings either plain or graphited. Available in a wide variety of bronze alloys or in steel and babbitt. Made to exacting specifications. A very economical type of bearing.

The MOST COMPLETE SLEEVE BEARING SERVICE in the world

JOHNSON BRONZE COMPANY

Sleeve BEARING HEADQUARTERS

525 SOUTH MILL STREET • NEW CASTLE, PA.


TRUE BLUE TO JUST THE RIGHT TURN
TYPE A FLAT HEAD
TYPE A OVEN HEAD
TYPE A OVAL HEAD
TYPE Z ROUND HEAD
TYPE Z HEXAGON HEAD
TYPE Z BINDING HEAD

in Hardness . . . Toughness . . . Uniformity . . . Accuracy . . . Tensile Strength . . . Color

★ We might be called too fussy about heat-treating Central Sheet Metal Screws to just the *right turn* . . . true blue. But there's no use putting flawless special analysis steel into a sheet metal screw, without this final Central "true-blue" heat-treating process that makes 'em stand up under the severest kind of strain or vibration.

"TYPE "A" "TYPE "Z" SHEET METAL SCREWS by Central

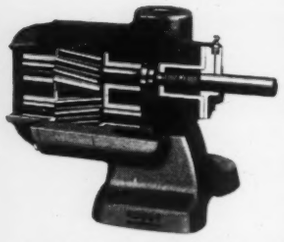
Without cost or obligation, let us send samples of Central "true blue" Sheet Metal Screws. Specify types "A" or "Z" in the size you need. Test them out on the toughest kind of self-tapping metal-to-metal assemblies. Treat 'em rough. We'll stake our reputation on your verdict. Write

CENTRAL SCREW COMPANY

3509 SHIELDS AVENUE • CHICAGO, ILLINOIS

There It Is...

THE NEW HYDRAULICALLY BALANCED **ROPER**



ONLY 2 MOVING PARTS . . . OTHER OUTSTANDING FEATURES

- FLANGED BRONZE BEARINGS also act as wearplates absorbing all wear usually placed on face and backplate.
- HYDRAULIC BALANCE with floating gears, drive shaft entirely separate from pumping gears.
- SPIRAL GEARS quiet at all speeds with high volumetric and mechanical efficiency.
- BUILT-IN RELIEF VALVE easily transposable, instantly changeable without disturbing face plate, gaskets, etc.
- 8 PIPING ARRANGEMENTS to employ the connection best adapted to the installation.
- MECHANICAL SEAL reduces power load and keeps leakage to a minimum.
- CAPACITIES from one to 1000 gallons per minute; PRESSURES up to 1000 pounds per square inch; SPEEDS up to 1800 r.p.m.

Write for Catalog 932 or see our catalog in Sweet's

GEO. D. ROPER CORP., ROCKFORD, ILLINOIS

ROPER Rotary PUMPS

tric & Mfg. Co., East Pittsburgh. Capacitor sections are made by winding a special grade of paper with thin copper foil. Foils are bonded on one end to the water tube so that they conduct heat to the water and carry the current. Leads are brought out at the center and the terminals of each group of sections are near the ends of the case.

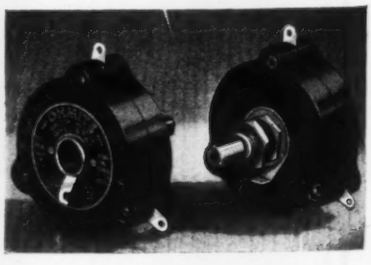
Switch Has Two Types of Actuation

AN EXPLOSION-PROOF switch announced by Micro Switch Corp., Freeport, Ill., is unusually compact and for use in hazardous locations, Class I, Groups C and D, and Class II, Group G. Types of actuation now available are the roller arm with the axis of the roller either parallel to or at right angles to the arm, and a bullet nose push rod type. Maximum movement differential is .001-inch. Mounting space is kept to a minimum by omitting feet or lugs and providing a pair of holes on each of four sides. A removable cover plate provides easy access to terminals and the switching unit enclosed within the cast iron housing is the standard precision micro switch.

Mounting space in explosion-proof micro switch is kept to a minimum by omitting feet or lugs and providing holes on sides

Rheostat Indicates Position

DESIGNED for use on direct current up to 24 volts, Model DR-125 direction indicator rheostat is offered by Ohmite Mfg. Co., 4835 Flournoy street, Chicago. Connected to the moving part of radio rotary beam antennas, direction-finding loop antennas, wind-vanes, etc., it is used to send an indication of the position to a remote point. It has a 360-degree continuous winding.



With a 360-degree continuous winding, direction indicator rheostat is connected to moving part of radio rotary beam antennas

System Controls Speed by Thermostat

PERMITTING automatic control of the take-off shaft speed by means of a thermostat, float switch or other control, a system of electric remote control has been adapted to the Varidrive motor made by U. S. Electrical Motors Inc., Los Angeles. It consists of a small worm gear reducer mounted on the Varidrive control case and connected to the control shaft which changes the speed. The pilot motor is operated by thermostat, float switch or other means through a cyclic relay or process timer. The thermostat or float

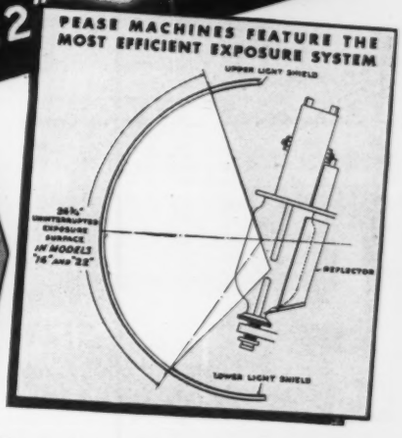
MEET FACTOR "X"

one of the **MOST IMPORTANT COST ITEMS** *in Blueprinting*

. . . YET OFTEN OVERLOOKED

Operating costs of the 3 New Pease Streamliners include Factor "X" yet show a lower total cost per square foot than any other blueprint machine on the market.

SLIDING CONTACT!



●*The greatest exposure area of any continuous blueprinting machine on the market.*

Factor "X" is the labor cost involved in producing blueprints — and here is a hypothetical example of the way it works.

Machine A (not of Pease manufacture) using a certain blueprint paper at a certain fixed color constant (the only true scale in comparing prints) uses 40 amperes on a certain constant line voltage and produces prints at 10 feet per minute. The corresponding Model Pease Machine prints on the *same identical paper* with the *same tracings* and under exactly the *same conditions* securing the *same identical color* and uses *50* amperes but prints at *15 feet per minute.*

Therefore, in this example, *Factor "X"* or the number of labor hours required for the same number of prints, is reduced by ⅓ in the Pease Machine. And, in addition, although the Pease Machine uses 25% more amperage it operates only ⅔ as long for the same amount of work, thus it actually consumes 8⅓% less current. It becomes obvious, then, that the Pease Machine operates at a much lower cost per sq. ft. of finished prints—prints of exceptional quality and flatness too.

This hypothetical case is borne out by certified figures in Blueprinting shops all over the country.

THE C. F. PEASE COMPANY

2606 West Irving Park Road . . . Chicago, Illinois

Get the certified figures of actual test cases or—better yet—let us make a survey based on your costs and show you the savings with the Pease Machine

FOR LONGER LIFE

in MACHINERY PARTS

Lathe centers tipped with KENNAMETAL outlast centers of high speed steel 50 to 100 times.

specify . . .

KENNAMETAL

at points subject to wear.

The best machine ever designed can prove a dismal failure if excessive abrasive action wears out its moving parts. One of the best ways to prevent such action is to specify KENNAMETAL at points subject to wear. A small piece of KENNAMETAL so used may add years to the life of your machine.

KENNAMETAL is an intermetallic compound of tungsten-titanium carbide possessing extreme hardness (79 Rockwell "C" for grade K3H) and greater strength than ordinary carbide materials. A Kennametal engineer will gladly show you how it can be adapted to your design problems. Send for him today.

McKENNA METALS Co.

146 LLOYD AVENUE

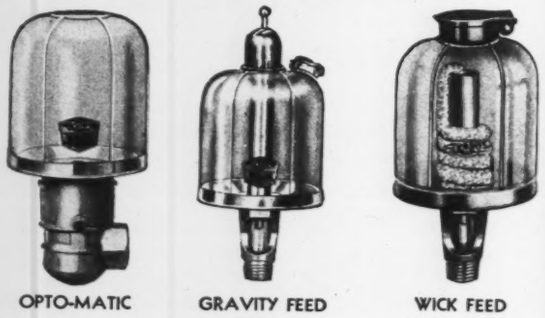
LATROBE, PENNSYLVANIA, U.S.A.

OILERS

ALL SIZES

Glass and Unbreakable Types

TRICO visible automatic lubrication is the ultra-modern way to stop waste and failures caused by old-fashioned trust-to-luck hand oiling methods.



OPTO-MATIC GRAVITY FEED WICK FEED

DRIP-DROP

LEVOMATIC

TRICO

REG U S PAT OFF

OPTO-MATIC

WRITE FOR BULLETINS

TRICO FUSE MFG. CO., Milwaukee, Wis.

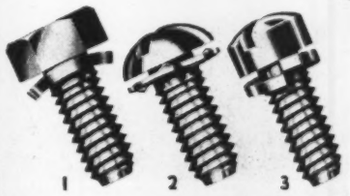
In Canada: IRVING SMITH LIMITED, Montreal

switch controls the direction of speed change while the cyclic relay governs the rate of change.

Screws Preassembled with Washers

THREE types of "Spring-Tite" fastening assemblies, comprising screws preassembled with spring washers, are announced by Reliance Spring Washer division, Eaton Mfg. Co., Massillon, O. The illustration shows respectively a hexagon head screw preassembled with a Reliance Springlock; a round head capscrew

For applications where space is limited and assembly speed is essential, three types of fastening assemblies are offered



preassembled with a tension washer; and a fillister head screw preassembled with a Knolink spring washer. These fastenings are particularly recommended for applications where space is limited and where speed of assembly is essential.

Micrometer Knob Utilized in Timers

A NEW micrometer adjusting knob and indicator has been developed and is incorporated in the latest timers and relays made by the R. W. Cramer Co., Inc., Centerbrook, Conn. Principal features of the device are the simplicity, neatness of appearance, ruggedness of the mechanical assembly and the ease with which it permits accurate adjustment of the timer settings. A knurled knob drives a worm gear which in turn moves a pointer across the dial at a slow rate.

Motors Designed for Pump Mounting

DEVELOPMENT of a line of motors with standard dimensions and designed for easy mounting of centrifugal and similar pumps is announced by Sterling Electric Motors Inc., Los Angeles. For operation on 3-phase at 2, 4, and 6-pole speeds, the motors are rated from ½ to 40-horsepower. The extended shafts and machined fits for the pump mounting are all standard. A large neoprene washer on the shaft between the pump packing and motor bearing in combination with an ingenious trough cast around the bearing makes it impossible for any of the material pumped to find its way into the motor bearing. The projecting shaft is covered with a special hard stainless steel tube which is ground and polished at the time the shaft is made.

Engineering Dept. Equipment

Fastener Staples and Tacks

CALLED the B-8 fastener, a pocket-size fastening device is announced by Bostitch Inc., East Greenwich, R. I. It can be used for such purposes as stapling together blueprints or tacking papers to drawing boards. Fifty sheets of 16-pound bond paper may be fastened with a single stroke. Made of steel and plastics, the fastener's base is detachable, in which case the unit drives staples like a pair of pliers. When the clincher blade is swung back, the machine becomes a tacker.

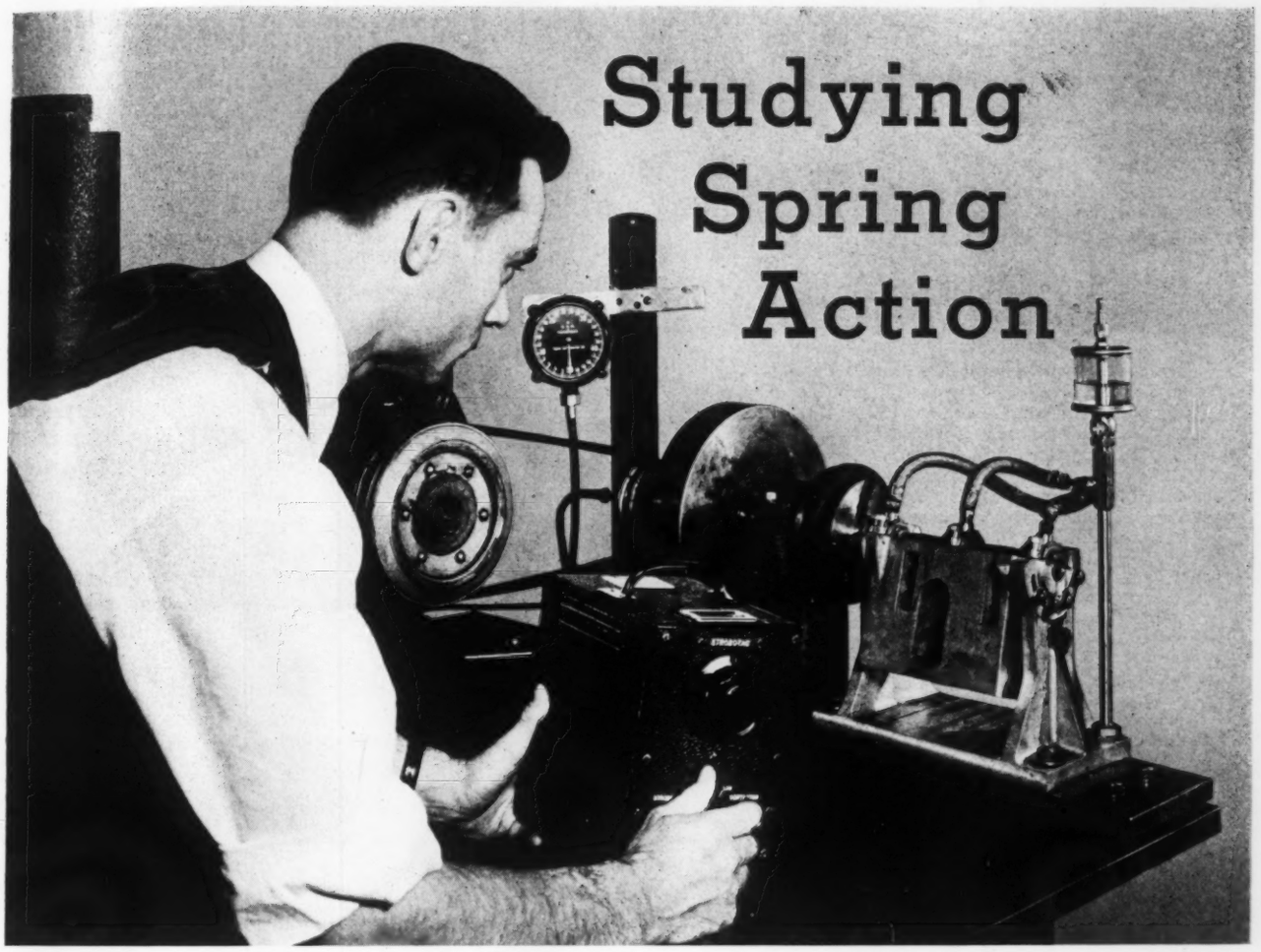


Photo Courtesy The Wm. D. Gibson Co.

THIS ENGINEER in the laboratory of the William D. Gibson Company of Chicago, manufacturers of the well-known GIBSON-SPRINGS, is using the STROBOTAC to study the action of springs operating at high speeds.

The particular set-up shown duplicates the action of valve springs in a racing car motor. The Gibson Company "has found the STROBOTAC invaluable in detecting and correcting abnormal conditions of deflection and stress frequently occurring in such high-speed operation"; the STROBOTAC is the only instrument which visually slows down motion (even to as slow as a fraction of an rpm) in machines and parts while they are operating at speeds even as high as 100,000 rpm.

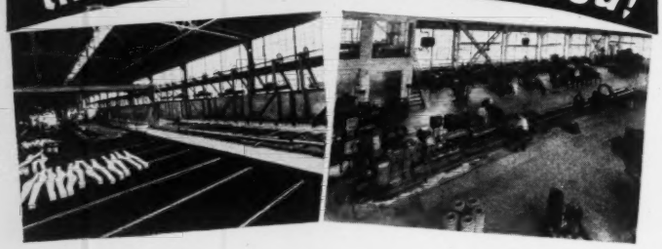
The Gibson Company further advise us that: "Precision measurements on our spring testing machines are made possible with the aid of the STROBOTAC while the machine is operating at predetermined speeds. Vibration, belt slippage, bearing play, over and under throw of reciprocating parts and the deflection of highly stressed parts are other examples of our production machine problems which we study with the aid of the STROBOTAC *under conditions of actual operation.*"

Users of the STROBOTAC throughout the entire mechanical field tell us that this simple, moderately priced, easy-to-use instrument has proven invaluable in research, design, testing, production, maintenance and sales. The STROBOTAC can help you. Let us tell you how.

Write for Bulletin 610 for Complete Information

GENERAL RADIO COMPANY CAMBRIDGE MASSACHUSETTS

FACILITIES
that Mean Savings for You!



Beside our well-equipped steam hammer, drop and upset forgings departments capable of turning out many hundreds of tons of forgings a day, and our heat-treating department with one of the largest batch furnaces in existence, we operate a large, modern machine shop equipped for any machining that we could be called upon to do—fast and economically. Large stocks of specification steels are carried on hand at all times—ready to go into the forging furnaces at a moment's notice.

We produce forgings of all types—rough, heat-treated, semi-machined or completely finished ready for assembly. These facilities are saving for many manufacturers whose own shops are at this time glutted with production. How about you—can we help you out? Send blueprints for quotation or have our representative call.

KROPP FORGE COMPANY
World's Largest Job Forging Shop
5315 W. Roosevelt Rd., Chicago
Representatives in Principal Cities

BLUE Devil
The ARISTOCRAT of SOCKET SCREWS
Try our service on your special sizes.
1—Cold-formed heads—unimpaired continuity of fibres.
2—Tensile strength 215-225,000 lbs. per square inch.
3—Precision formed hexagon socket with true sides and no taper.
4—Chamfered edge knurled to facilitate assembly.
Blue Devil Cap Screws are unbelievably tough, and are heat treated in electrically controlled furnaces. Send for catalogue and samples.
Nothing too large-Nothing too small for
SAFETY SOCKET SCREW CORPORATION
4447 N. KNOX AVE., CHICAGO, ILLINOIS

Well Planned Patent Claims

(*Concluded from Page* 47)

transmitting means to the spring mass, and connecting means for connecting the *opposing lever arm* transmitting means to the unsprung mass.

Claim 6 reads on the "opposing lever arm" type of stabilizer in *Fig.* 2. An additional claim number 7 may be drafted to read on the "opposing hinge type" of stabilizer in *Fig.* 3 by injecting the qualifying words "opposing hinge" before the words "transmitting means" in Claim 5. Similarly, an additional Claim 8 may be drawn to read on the fluid stabilizer in *Fig.* 4, by inserting the word "fluid" before the words "transmitting means" in Claim 5.

In this manner a large number of claims may be obtained, each differing from the other in various particulars and serving to illustrate how so many claims may creep into an ordinary patent to protect a broad field of design involving several modifications. By having a large series of claims, varying from a broad claim to a rather narrow claim, the patentee builds up a defense not unlike modern warfare, so that in the event a competitor designs around some of the claims, he is stopped by the others.

Articles in succeeding issues will discuss other important phases of claim drafting.

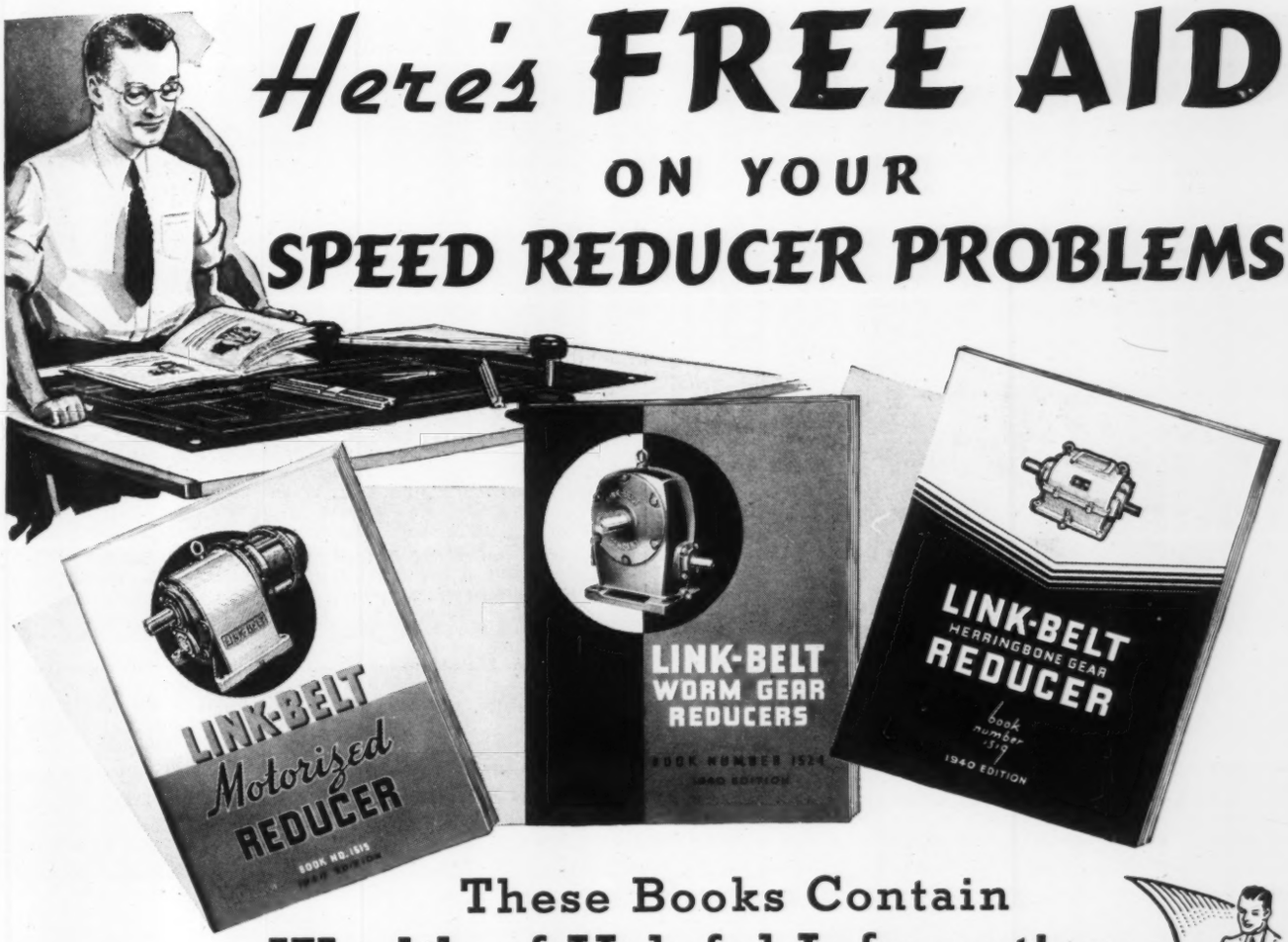
Solenoids Speed Control

(*Concluded from Page* 44)

the excess energy but springs have been found to be much simpler for this purpose. If the coils are subjected to splashing liquids such as oil, water or coolant compounds, they should be specially treated to guard against injury from these causes. Another typical application to a machine part is shown in *Fig.* 6. The solenoid operates a spring controlled brake.

Use of solenoids for multi-motored machines and sequence control is a well recognized field and is growing rapidly. Undoubtedly many improvements will be made in solenoid construction. One weakness of many present-day solenoids lies in poor facilities for wiring to the coil terminals in any manner which will approach code requirements. Wiring according to the code for machine tools must be completely in conduit from fitting to fitting and adequately protected against entrance of oil or water into the conduit system. Many present day solenoids do not provide anything to which a conduit can be anchored. The coils also are open and exposed to oil dripping and splash. Completely enclosed or iron clad solenoids would be more acceptable from a wiring standpoint, but the coils in such cases would necessarily have to be wound with glass fiber insulation or at least insulation which would stand high temperatures. Such a thing is certainly not an impossibility and developments along that line may well be expected.

Here's FREE AID ON YOUR SPEED REDUCER PROBLEMS



These Books Contain a Wealth of Helpful Information

● Here is just the help you want when you face the problem of selecting speed reducers. These books are packed with valuable technical data on

— No. 1519-A—Herringbone Gear—for general all-around ruggedness, efficient high speed operation and ability to withstand shock loads.

— No. 1524—Worm Gear—where large ratios, flexibility of arrangement and enclosed drives of the right-angle type or a variety of other shaft set-ups, are required.

— No. 1515—Motorized Helical Gear—a compact, self-contained combination of speed reducer and integral motor, requiring no base plate nor flexible coupling.

They illustrate and describe the features of each type and show how to determine the right size and ratio for your particular application. 8263

LINK-BELT MAKES A COMPLETE LINE OF POSITIVE DRIVES

SEND FOR ALL THREE RETURN THIS COUPON

LINK-BELT COMPANY
307 N. Michigan Ave., Chicago.

Please send Data Books checked:

☐ MD 1519-A HERRINGBONE GEAR REDUCER

☐ MD 1524 WORM GEAR REDUCER

☐ MD 1515 MOTORIZED HELICAL GEAR REDUCER

Name.....

Firm.....

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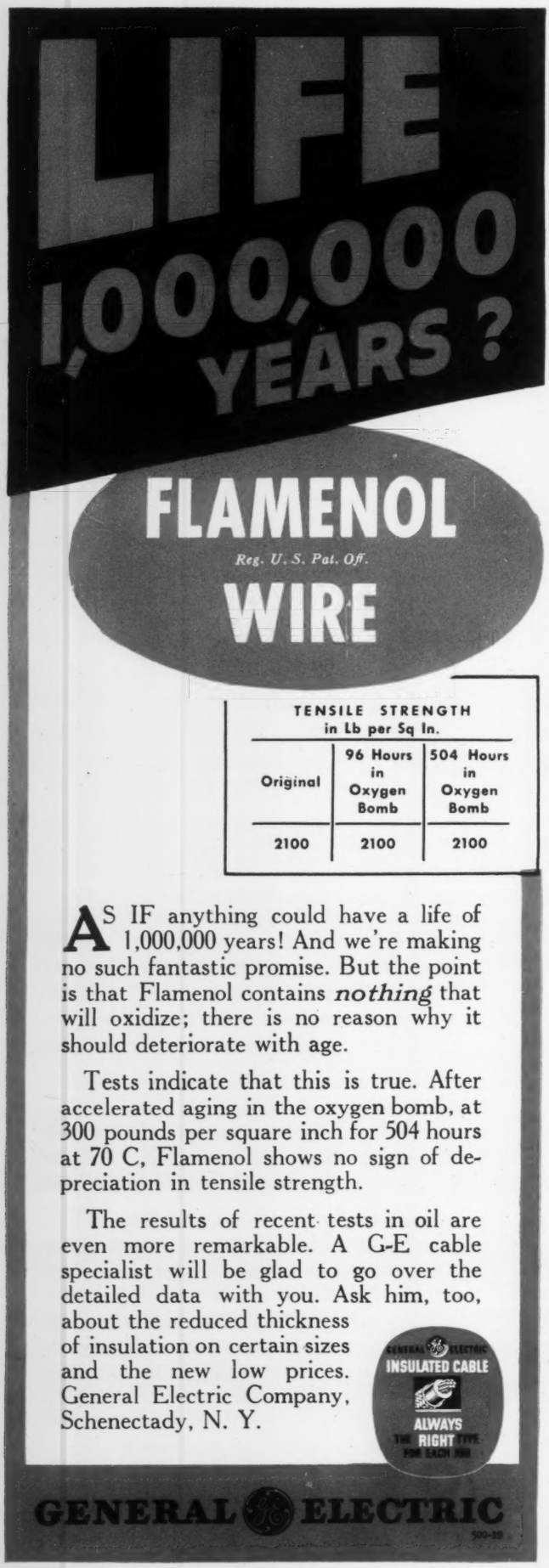
City.....State.....

LINK-BELT SPEED REDUCERS


LIFE
1,000,000
YEARS ?
FLAMENOL
Reg. U. S. Pat. Off.
WIRE
TENSILE STRENGTH
in Lb per Sq In.
Original
96 Hours in Oxygen Bomb
504 Hours in Oxygen Bomb
2100
2100
2100
AS IF anything could have a life of 1,000,000 years! And we're making no such fantastic promise. But the point is that Flamenol contains nothing that will oxidize; there is no reason why it should deteriorate with age.
Tests indicate that this is true. After accelerated aging in the oxygen bomb, at 300 pounds per square inch for 504 hours at 70 C, Flamenol shows no sign of depreciation in tensile strength.
The results of recent tests in oil are even more remarkable. A G-E cable specialist will be glad to go over the detailed data with you. Ask him, too, about the reduced thickness of insulation on certain sizes and the new low prices. General Electric Company, Schenectady, N. Y.
GENERAL ELECTRIC
INSULATED CABLE
ALWAYS
THE RIGHT TYPE
GENERAL ELECTRIC

Meetings and Expositions

Sept. 10—

National Association of Ice Refrigerator Manufacturers. Annual meeting to be held at Sherman hotel, Chicago. H. L. Covert, 310½ Broadway, Abilene, Kansas, is secretary.

Sept. 9-13—

American Chemical society. One-hundredth national meeting to be held in Detroit. Charles L. Parsons, 728 Mills building, Washington, is secretary.

Sept. 15-21—

Twenty-fourth Annual Eastern States exposition to be held in Springfield, Mass. Additional information may be obtained from J. H. Fifield, Eastern States Exposition, Springfield, Mass.

Sept. 16-19—

American Mining Congress. Annual metal mining convention and exposition to be held at Colorado Springs. Julian D. Conover, 309 Munsey building, Washington, D. C., is secretary.

Sept. 18-20—

National Industrial Advertisers association. Annual meeting to be held at the Hotel Statler, Detroit. Miss M. R. Webster is headquarters secretary, 100 East Ohio street, Chicago.

Sept. 23-26—

American Transit association. Fifty-ninth annual meeting to be held at Greenbrier hotel, White Sulphur Springs, W. Va. Guy C. Hecker, 292 Madison avenue, New York, is general secretary.

Sept. 24-25—

Society of Automotive Engineers Inc. National Tractor meeting to be held at Schroeder hotel, Milwaukee. John A. C. Warner, 29 West Thirty-ninth street, New York, is secretary and general manager.

Sept. 24-27—

Association of Iron and Steel Engineers. Annual meeting to be held at the Stevens hotel, Chicago. Brent Wiley, 1010 Empire building, Pittsburgh, is managing director.

Oct. 12-19—

National Dairy association. Meeting and exposition to be held at Harrisburg. Lloyd Burlingham, 308 West Washington street, Chicago, is secretary.

Oct. 14-16—

American Gear Manufacturers' association. Twenty-third semiannual convention to be held at Skytop Lodge, Skytop, Pa. J. C. McQuiston, 602 Shields building, Wilkinsburg, Pa., is secretary.

Oct. 16-18—

Porcelain Enamel institute. Annual meeting to be held at University of Illinois, Urbana. C. S. Pearce is secretary, 612 North Michigan avenue, Chicago.

Oct. 17-19—

American Society of Tool Engineers. Semiannual convention scheduled for Cincinnati. Additional information may be obtained from Ford R. Lamb, 2567 West Grand boulevard, Detroit, executive secretary.

Oct. 17-23—

Wire Association. Annual meeting and exhibition to be held at Carter hotel, Cleveland. Richard Evan Brown, 300 Main street, Rooms 609-13, Stamford, Conn., is secretary.

Oct. 20-25—

American Welding Society. Annual meeting and exposition to be held at Hotel Cleveland, Cleveland. Miss M. M. Kelly, 807 Riverside Drive, New York, is secretary.

Oct. 21-25—

American Society for Metals. Annual meeting to be held at the Hotel Statler, Cleveland. W. H. Eisenman is secretary, 7016 Euclid avenue, Cleveland.

Professional Viewpoints

(*Concluded from Page* 59)

made to determine the practicability of reproducing working drawings and other valuable data from these minute negatives. We now proceed with full confidence that should we lose every one of our working drawings and original tracings we could be operating again within a week.

In addition to working drawings we have also a microfilm copy of the essential data of every order received by us. Loss of our order files will never destroy our ability to handle efficiently repairs and service to hundreds of thousands of our installations all over the world.

We believe that this protection to both our customers and ourselves is worth all it costs in money and time.

—G. B. WRIGHT
Nash Engineering Co.

"... does not affect brazed joint"

To the Editor:

IN YOUR article "Induction Hardening Offers Design Economies" you discuss the adaptability of this method to various machine parts. At our plant, induction heating is utilized to heat treat valve tappets. The steel cup end which is brazed into the iron tappet is treated in this way primarily to obtain sufficient heat for the hardening of this cup end, without the possibility of the heat affecting the brazed joint.

The machine as set up for production is made up as a double-headed rotating wheel which carries the tappets through the induction coil, heating them to the desired temperature and immediately quenching from this temperature with a water jet that is built into the exit end of the induction coil.

This set-up has been entirely satisfactory and is producing tappets at the rate at 4800 pieces per hour.

—E. H. KELLEY
Chevrolet Motor Division

"... is timely"

To the Editor:

IN MR. Woodling's article "Outside Inventions Often Foul Developments" in your June issue there appears a copy of a notice recommended as being one which could be used advantageously on drawings. The notice begins, "This drawing is the property of X. Y. Z. Company ..."

We have just finished printing the following notice on red gummed paper which we plan to affix to our drawings. Tell us whether you think this notice serves the intended purpose.

NOTICE

This print is the property of the Easton Car & Construction Co., and is to be returned upon request. It

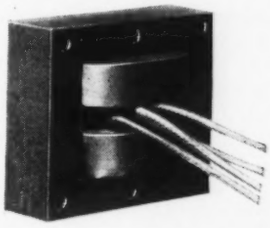
TRANSFORMERS

Tailored

TO YOUR PRODUCT

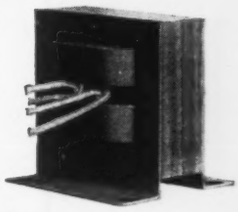
You can probably find—in our extensive line of small transformers—one to fit into your particular signal and control auxiliaries. If not, we can supply transformers to meet almost any requirement by using standard G-E transformer parts in various combinations. All parts with the exception of the core and coils are optional.

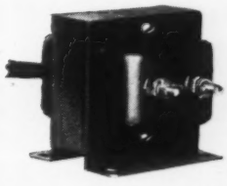
For example:



You can buy only the core and coils

—or, you can buy them with mounting-feet attached





—or with end cases, leads, and terminals

—or with almost any other special mounting or enclosing feature to fit your needs.

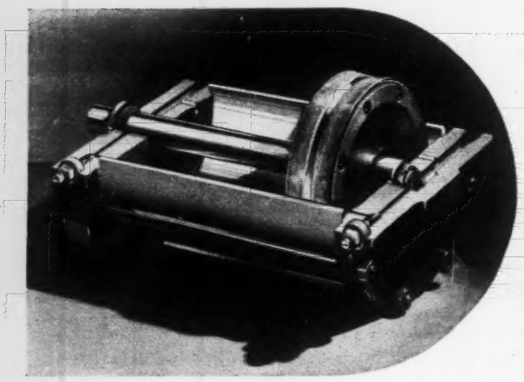
If your product includes small built-in transformers, you should investigate the G-E "tailored" line. Send us the details—we'll be glad to quote prices and offer recommendations. General Electric, Schenectady, N. Y.

Write for Bulletin GEA-1358D

GENERAL ELECTRIC

453-11

adjustable "cushioned" air cylinder strokes



The action of the cushioned part of an air cylinder stroke depends on variables that are, at best, difficult to determine. This condition can be offset in part by having this cushion action adjustable. Cushion adjusting screws operate to "slow" or increase the speed of the cushion action.

T-J CUSHIONED AIR CYLINDER

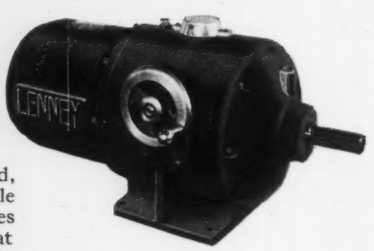
Complete specifications of Cushioned and Non-Cushioned types are shown in our Catalog 36-A. Your copy will be sent promptly. Address The Tomkins-Johnson Co., 618 N. Mechanic Street, Jackson, Mich.

Furnished as standard equipment on T-J Cushioned Air Cylinders, these screws may be readily adjusted and locked in position on the job.

this is a **TOMKINS-JOHNSON** *product*

LENNEY
VARIABLE SPEED
TRANSMISSION

With speeds instantly adjustable to a fraction of an R.P.M.



● Completely redesigned, this new Lenney Variable Speed Transmission provides instant control of speed at the touch of a finger—exactly the speed required is furnished and maintained. This method of control, because of its simplicity, is one of the outstanding features.

Compactness and streamline appearance of the drive are important assets which appeal to designers searching for a unit to be incorporated as an integral part of any type of machine. It is a modern source of power characterized by high quality workmanship.

If you have a problem involving the method of mounting, location of the speed control calling for special treatment, or need a speed indicating mechanism other than standard, our engineering department will gladly co-operate in solving these or other engineering problems you have in the selection and application of a drive. The benefit of years of study of variable speed transmission problems is at your disposal.

The Lenney unit is available in sizes from ⅛ to 7½ horsepower. Write for catalog giving complete details.

THE LENNEY MACHINE & MANUFACTURING CO.
WARREN, OHIO

is loaned to you with the understanding that it is to be used for purposes of record and repair only and not in any way detrimental to the interests of Easton, that is, it is not to be copied or reproduced in whole or in part, and information from it shall not be furnished to others. All rights of design and invention are reserved by Easton.

Mr. Woodling's article is timely. Thank you for printing it.

—J. C. FARRELL, Vice President
Easton Car and Construction Co.

Mr. Woodling has reviewed the notice and suggests the insertion of the word "confidential" before the word "property" would strengthen the notice. The word confidential is not exactly essential but would give increased weight to the import of the notice.—ED.

Accounting Machine Obviates Operations

(*Concluded from Page* 37)

4 supports the bushings for the sensing fingers. To prevent these bushings from turning they are machined from square stock, thus leaving a square head. This plastic is provided with a groove into which the head of the bushing is recessed. The outer contour is also grooved to keep the cable terminals from turning when the nut clamping the bushing together is tightened. The mold is supported by two semicircular castings which serve for the mounting of the entire unit.

Aluminum alloy casting, *Fig.* 5, supports the relays and solenoids. This casting is easily machinable, light in weight and yet provides the necessary sturdiness to support the various contacts, relays and magnets. The cable connections between the various parts of the machine must be separable from the main frame and the especially constructed terminals shown at right in *Fig.* 6 provide an excellent means to condense as many as twenty connections in a limited space.

Terminals consist of a strip of insulating material with twenty terminal lugs molded into each. The lower half is drilled and tapped and the upper half is provided with a clear hole through each lug. This enables two terminal strips to be assembled with screws through each lug, and the combined pressure of all screws is so great that a reliable contact for each connection is established.

Possibility of increasing automaticity, as described herein by means of applying electricity to accounting machines, is limited only by the ingenuity of the designer.

American Gear Manufacturers Assn. reports that gear sales for July were 9.3 per cent above June and 58 per cent above July 1939. The seven months ending with July 1940 are 38 per cent above the same corresponding period for 1939. Machinery manufacturers in general will be interested in these statistics inasmuch as gear sales are a reliable index to the trend in design, production and sales of machinery.

Surface Coatings Affect Steel Properties

(*Concluded from Page* 54)

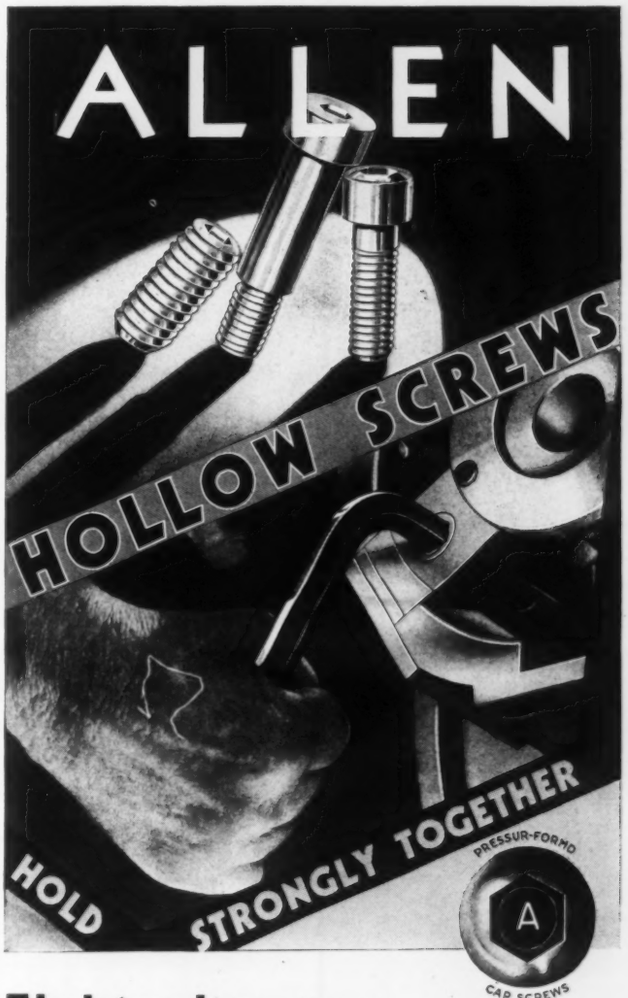
of the endurance limit only a slight discoloration of the surface could be detected.

Only a few tests were made of specimens with surfaces coated with bakelite varnishes and the results for each specimen tested are shown in TABLE II. By comparison with the S-N curves in *Fig.* 2 it will be noted that all of these bakelite varnishes were effective in increasing the life of the specimen beyond that of the untreated steel, and that two of these varnishes apparently increased the corrosion-fatigue endurance limits to values above those obtained for any of the other coatings employed on the S. A. E. 3140 steel. It was found difficult to obtain a good uniform adherence of the varnish without the necessity of roughening the surfaces of the specimens and the fractured specimens showed an irregular distribution of corrosion pitting at localized areas in which the varnished surface had dust particles imbedded or had cracked at random when stressed during the test. For service conditions in which abrasion is not likely to occur, some of the bakelite varnishes may offer an effective means of protecting a member from localized corrosive attack and should materially increase the corrosion-fatigue strength of a member if an impervious adherent coating is obtained.

Summary of Platings and Cases

In general, the corrosion-fatigue endurance limits for specimens with commercially used protective coatings were considerably below the endurance limits of the steels tested in air. Specimens with a silicon impregnation case exhibited the same endurance limit when tested in air or in water, but the value obtained for this endurance limit was comparatively low (about 22,500 pounds per square inch). Zinc-plated specimens had a greater corrosion-fatigue strength than the cadmium-plated specimens, but both platings were rather thin and gave endurance limits less than 45 per cent of the fatigue strength of the uncoated steel in air. Specimens with a nitrided case were very efficient in resisting pitting by corrosive attack, and a very high corrosion-fatigue strength was obtained for the nitrided specimens (85,000 pounds per square inch).

In this day of special alloys and refined metal finishes in machine parts, the contribution of the Rockwell hardness tester by its inventor, Stanley P. Rockwell, is recognized as being instrumental in advancing machine design. Mr. Rockwell developed the hardness tester while associated with New Departure. In 1939 he was awarded the Sauveur medal by the American Society for Metals for his achievements in metallurgy. His death, August 11, as a result of an explosion on his yacht is a severe loss to the engineering profession.



Tightening up

Impetus of rearmament programs presses on to take up the slack in production, and where do you find the "slack" so recurrent as in equipment tie-ups, down-time of machines, lost time of mechanics and operators?

The tightening up of loose operating practices implies tightening up of machine assemblies and adjustments of all kinds — specifically by use of Hollow Screws that HOLD above all others!

It's hardly needful to *name* the screws, in view of the fact that the *same* make of screws has held the Quality market for 30 years, — some of which decidedly were years of "tightening up".

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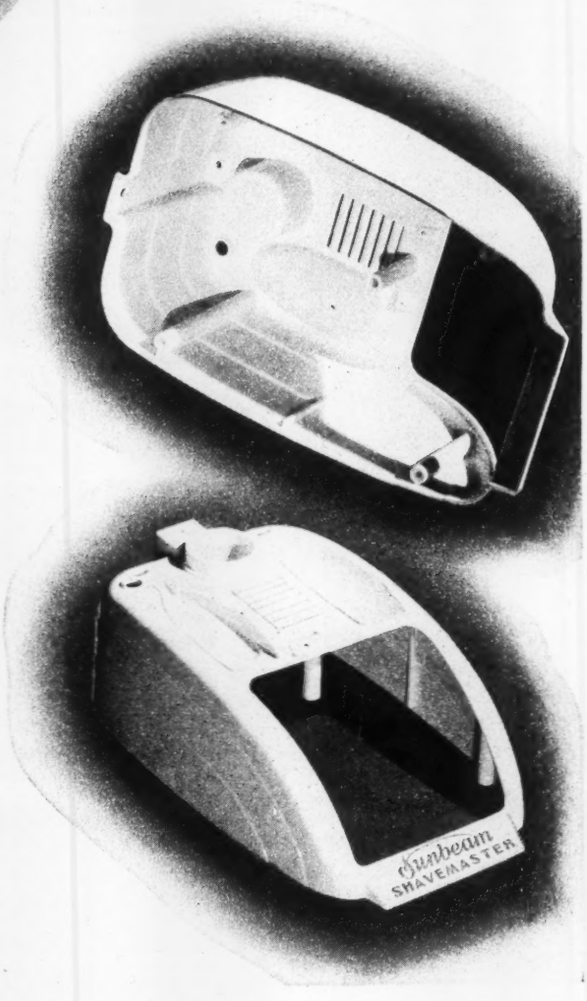
PLASTIC MOLDED

DEMONSTRATOR DISPLAY SELLS THE

Sunbeam SHAVEMASTER



Plastic Molded Demonstrator Displays are doing a good job of selling Sunbeam Shavemasters for Chicago Flexible Shaft Co. Plastic Molded housings, molded by Chicago Molded Products Corporation are an important feature of Sunbeam Shavemasters. These are but two applications of many thousands where Plastic Molded Parts have aided the sale, improved the quality and appearance and brought about decided economies in production. Many builders of industrial machinery find the use of Plastic Molded Parts a valuable factor in furthering the sale and lowering the manufacturing costs of their product. This is something *You* might do well to consider. Our engineering staff will give you prompt, capable action on any phase of engineering for Molded Plastics. You incur no obligation in writing us.

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No better term could be applied to the European conflict than, "A battle of Machines." Out of peacetime developments engineers have created implements of war—armored cars, tanks and airplanes. These have superseded hand-to-hand fighting.

This aspect of technological progress may not appeal to the better side of human nature but out of the chaos will come a new role for mechanization. History will prove that the nation which girds itself with machines of defense is less likely to be invaded. The machine must be recognized as the guardian of mankind.

Whether for war or peace, design cannot falter. On economic fronts as well as battle fronts its importance is the same. New ideas, better performance, improved appearance, more economical production—all these are in the hands of the designer.

MACHINE DESIGN will assist in this objective by serving as a clearing house for new ideas involving the application of parts and materials in the design of machines. It recognizes its responsibility to do its part in inspiring the development of improved machinery of all types and sizes. Only thus can a peaceful and prosperous future be assured.

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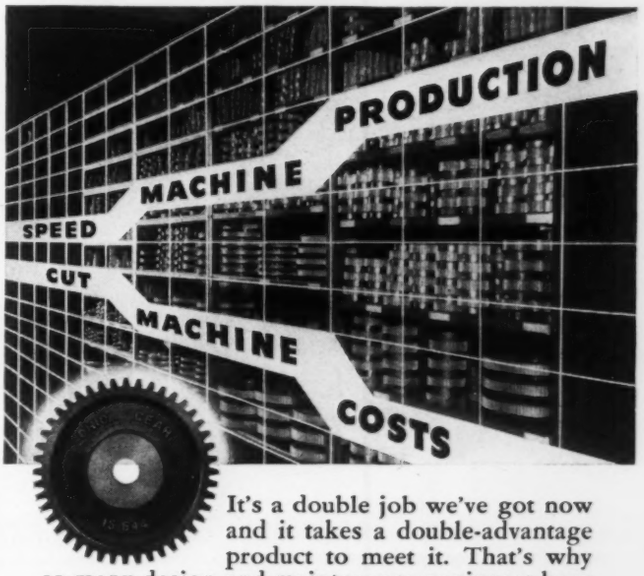
DO 2 JOBS WELL!



It's a double job we've got now and it takes a double-advantage product to meet it. That's why so many design and maintenance engineers have turned to Ohio Stock Gears for their power transmission needs. They've found Ohio Stock Gears speed production and cut costs in these definite ways:

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OHIO GEARS

HERE'S 1 OF 41

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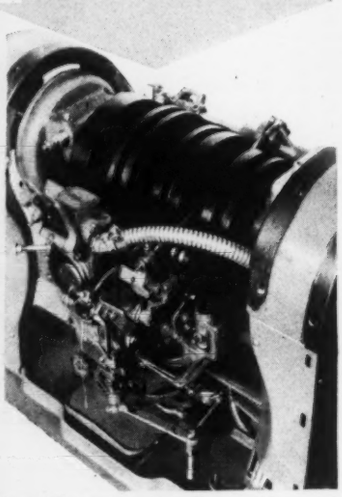
Forty-one different applications of G-E Textolite laminated sheets, rods, tubes and fabricated parts have been selected by United Shoe Machinery Corp. engineers in their constant improvement of their products.

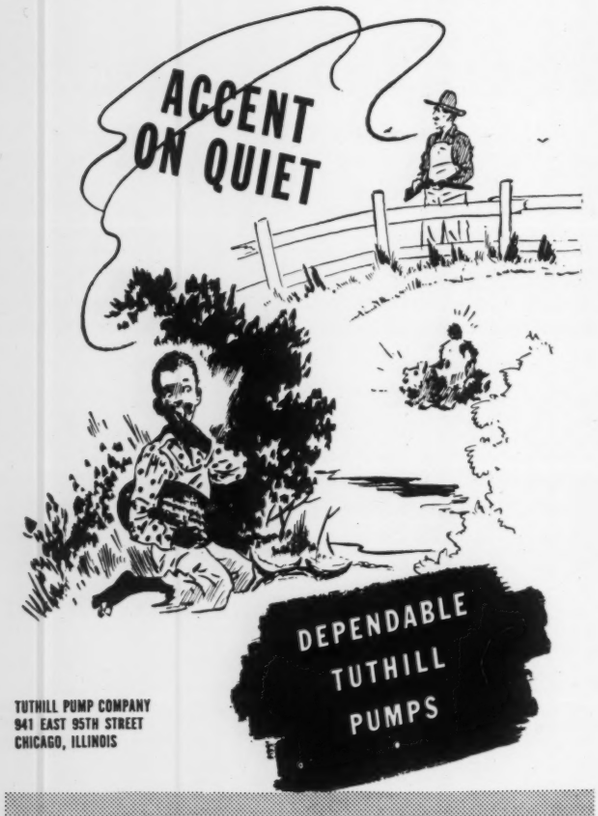
Terminal blocks, heat insulators, coupling centers, permanently lubricated track slides, shock absorbing and impact applications are only a few. United Shoe has 41. You, too, can benefit from this durable and resilient material that is easily punched and machined.



Write Section H-60, Plastics Department, General Electric Co., One Plastics Avenue, Pittsfield, Mass.

GENERAL ELECTRIC

PD-803



TUTHILL PUMP COMPANY
941 EAST 95TH STREET
CHICAGO, ILLINOIS

WRITE FOR GENERAL PUMP CATALOG

MEN OF MACHINES

(*Continued from Page* 60)

tute of Technology), and the following year was promoted to full professor—the post he now holds. Professor Sorensen has also been engaged in consulting practice in various fields and has been a member of AIEE since enrolling in his student days in 1904. He has been active in the affairs of the institute since that time and has written several papers, one of which received a national prize. He is also now serving as a vice president of the Society for the Promotion of Engineering Education and is a member of the Engineers' Council for Professional Development.

♦

KENNETH K. BOWMAN, M. A. EDWARDS and FRANCIS MOHLER, General Electric engineers, were among those who recently received the Charles A. Coffin foundation awards, the highest honor conferred by the company upon employes adjudged to have made the most outstanding contributions to their company and to the electrical industry.

♦

JOHN H. ALSES, who has been active in engineering for 21 years, has been named chief inspector of Olds Motor Works. He has been a member of the Olds engineering department since 1925, becoming chief draftsman in 1926, and has served in other engineering capacities prior to his present appointment.

♦

FRANK W. CALDWELL has been appointed director of research of United Aircraft Corp., East Hartford, Conn., and ERLE MARTIN, engineering manager of the Hamilton Standard Propellers division. Both of these men have been identified with the organization for several years.

♦

COL. L. B. LENT, engineer and inventor, has been appointed executive secretary, American Engineering council, Washington. He succeeds Frederick M. Feiker, whose appointment as dean of engineering was announced in the July issue of MACHINE DESIGN.

♦

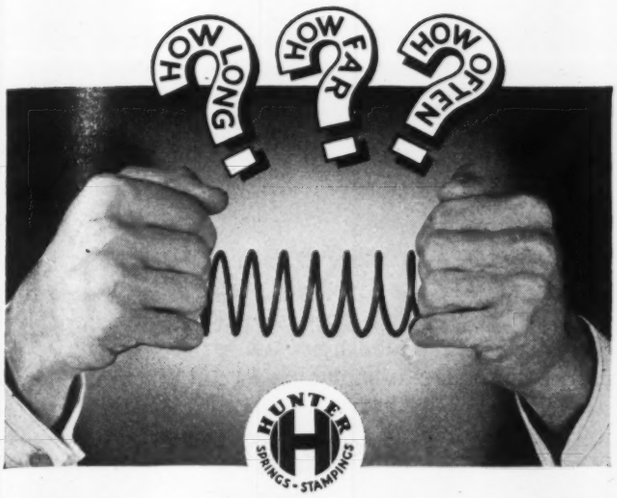
DR. ANDREY ABRAHAM POTTER was recently honored with the award of the Lamme Medal for 1940 by the Society for the Promotion of Engineering Education "for his many achievements in the advancement of engineering education and its application to industry."

♦

W. C. MORGENSTERN has recently been appointed assistant chief engineer at Copperweld Steel Company's new plant at Warren, O.

♦

ALLEN W. WILLIAMS after 27 years' of service has retired as managing director and treasurer of the



How long should it be? How far should it move? How often must it flex? How strong? What loads? What forces are required? These are a few of the simpler of the hundred odd considerations that make a good spring to do your job right. Accurate choice makes a vital difference to spring life—hence to the life and satisfactory performance of your product.

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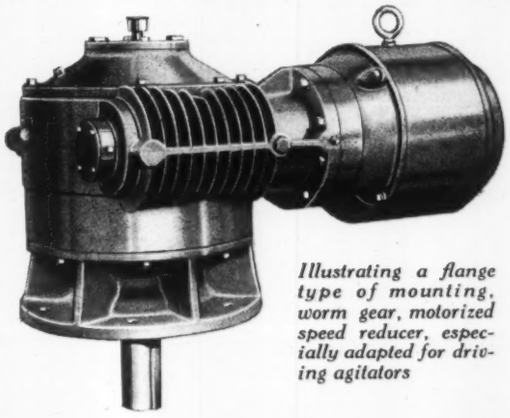

Illustrating a flange type of mounting, worm gear, motorized speed reducer, especially adapted for driving agitators

The symmetry, balanced design, pleasing appearance, number of sizes and types, permits Janette motorized or motorless, speed reducers to be adapted to and to harmonize with, any well designed machine. Hundreds of Janette speed reducers are used on voltage regulators and damper control apparatus in power plants, which must operate 24 hours EVERY DAY. Also for driving continuously operated processing machinery, where a single failure would cause heavy loss. Why not use the reliable Janette reducers for driving your machines?

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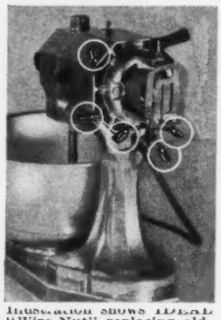


Illustration shows IDEAL "Wire-Nut" replacing old-fashioning solder and tape joint in kitchen appliance (cover removed).

IDEAL Wire-Nut

SOLDERLESS — TAPELESS WIRE CONNECTORS

Tapered spring insert presses clean threads into wires—acts as current carrying sleeve. ¼" moulded composition shell unaffected by heat, cold or moisture

National Warm Air Heating and Air Conditioning association, Columbus. He was one of the founders of the association and will continue in an advisory capacity. GEORGE BOEDDENER, recently assistant to the president of the association, will succeed Mr. Williams.

♦

CARLETON E. STRYKER has been added to the headquarters staff of the Society of Automotive Engineers to take charge of the Society's national defense responsibilities in establishing standards pertaining to aircraft and aircraft-engine parts and materials. Mr. Stryker is a well known Pacific coast aircraft engineer. Since the war he had been designer and engineer for the Airplane Development Corp., Glendale, Calif., and then became engineer of the Curtiss-Wright Technical Institute of Aeronautics at Glendale. At one time he was consultant for the Aeronautics Branch of the Department of Commerce.

♦

J. E. ARNOLD has joined the research division of the United Shoe Machinery Corp., Beverly, Mass.

♦

W. J. BUESCHLING, previously connected with Central Alloy Steel Corp., and Republic Steel Corp., is now chief metallurgist at Copperweld Steel Company's new steel plant at Warren, O.

♦

WILLIAM M. BARR, chief chemical and metallurgical engineer, Union Pacific Railroad Co., has been nominated as president of the American Society for Testing Materials. HERBERT J. BALL, head of the department of textile engineering, Lowell Textile institute, is the nominee for vice president.

♦

CHARLES H. HERTY JR., research and development department of Bethlehem Steel Co., Bethlehem, Pa., has been nominated chairman of the Iron and Steel division of American Institute of Mining and Metallurgical Engineers.

♦

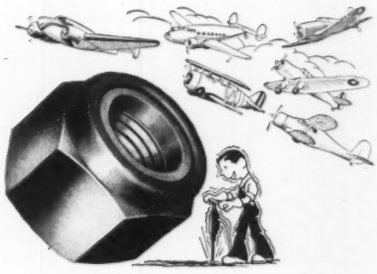
JAMES S. KNOWLSON, president and board chairman of Stewart-Warner Corp., has been elected president of the Radio Manufacturers association.

♦

GEORGE L. SNYDER, since 1937 assistant chief engineer of Lukenweld Inc., Coatesville, Pa., has been promoted to chief engineer. Mr. Snyder has been with this organization since graduating from Drexel Institute of Technology in 1935. He joined the engineering department.

♦

M. W. HUBER, who joined the Tuthill Pump Co. in 1933 as engineer in charge of development, has been appointed vice president in charge of engineering and production. Since joining the Tuthill company he has been responsible for a number of important developments in the company's pump division as well as in the refrigeration division.



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Whether you are making an automatic shell or an automatic toaster, the secret of getting the job out on time and at a profit lies largely in the quality of the springs and turnings.

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Business and Sales Briefs

W H. MILTON JR., sales manager for the General Electric plastics department at Pittsfield, Mass., for the past two years, has been appointed assistant manager, responsible to G. H. Shill, manager, for all activities. A graduate of Virginia Military institute, Mr. Milton has been associated with GE since 1920, joining as a student engineer.

♦

Construction has begun on a complete production plant at Milford, Conn., for U. S. Electrical Motors Inc., Los Angeles. The plant will be completed in November.

♦

L. A. Ver Bryck has been appointed manager of sales, Pittsburgh district, Pittsburgh Steel Co., succeeding W. M. Jensen, resigned. Mr. Ver Bryck has been in the sales department since 1928, except for a short period with Wheeling Corrugating Co.

♦

S. C. Merrill has been named assistant general sales manager, automotive division, Timken Roller Bearing Co., with headquarters in Detroit. Joining the New York office of Timken in 1922, Mr. Merrill was transferred to Detroit in 1936 as district manager of sales.

♦

Hydraulic Compressed Metals Inc., Indianapolis, has changed its name to General Metals Corp.

♦

W. B. Wilkins has been named sales manager, American Manganese Bronze Co., Philadelphia.

♦

L. H. De Wald is now sales metallurgist for Fansteel Metallurgical Corp. in the Cincinnati office.

♦

Formation of National Molded Products Inc. for the manufacture of self-lubricating bearings and other powdered metal products is announced by W. L. Strawbridge, president. Factory headquarters will be at 122 Mill street, St. Marys, Pa. Specially designed equipment, based on most recent developments in powder metallurgy, has been installed.

♦

M. A. Carpenter has been elected executive vice president and director of the Falk Corp., Milwaukee. He will continue as director of sales and advertising.

♦

Acquisition of Harris Alloys Inc. by Callite Tungsten Corp., Union City, N. J., is announced by Charles H. Kraft, president. Frederick T. Harris, former Harris executive head, has joined Callite Tungsten and will have full charge of operations of the new division. D. R. Donovan, general sales manager of Callite, will supervise sales activities of the Harris division.

♦

Haynes Stellite Co., unit of Union Carbide & Carbon Corp., is expanding its manufacturing facilities at its plant in Kokomo, Ind., by the addition of a 75 by 132-foot factory building to be ready for use shortly.

♦

Howard R. Salisbury has been appointed manager for Air Reduction Co. at Philadelphia, succeeding William W. Barnes, retired. With Airco for 15 years, Mr. Salisbury was previously assistant manager at Philadelphia for six years and is a past chairman of the Philadelphia section of the American Welding society. H. B. Seydel, formerly assistant sales manager of the New York district, becomes assistant manager at Philadelphia.

♦

Appointment of Sumner Pond as manager of its

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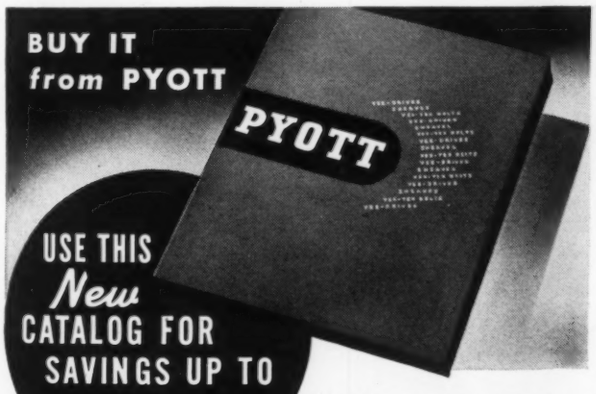

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Unusual savings in the cost of V-Belt Drives—as much as 20% in some cases—are made possible by the new V-Drive ratings. Pyott's new catalog on Vee-Tex Drives shows how you can benefit most by this development, how to select the cheapest drive for any job.

Nobody who specifies drives should overlook this money-saving catalog. Its 112 pages are full of interesting, important information. Write for Catalog E.

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Under all conditions of service . . . light-duty, heavy-duty, steady or intermittent shock loads . . . McGILL is **there** because there's a McGILL Bearing for practically every known bearing use. In addition, our engineering department is at the service of manufacturers who are designing new equipment requiring special custom-built bearings.

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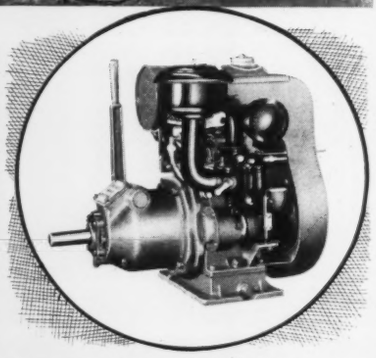
Proved best for any type of service. Safe — economical — sure. Extreme heat or bitter cold has no effect on WISCONSIN air-cooled engines. They are the only power plants that are designed for all weather operation.



Built in 12 sizes — 1 to 35 H.P.

Wisconsin Motor Corporation
MILWAUKEE, WISCONSIN, U.S.A.

KOH-I-NOOR
Drawing Pencils

10c
EACH

Manufactured in U. S. A.

KOH-I-NOOR PENCIL COMPANY, INC.
373 Fourth Ave.
NEW YORK, N. Y.

Detroit office is announced by Universal Gear Corp., Indianapolis. Mr. Pond, who has been associated with the factory sales department for two years, will have offices at 412 Curtis building 2842 West Grand boulevard. Universal Gear also has appointed James T. Castle and associates as district representatives for the Pittsburgh territory, with offices at 424 First avenue.

♦

R. T. Steindorf has been appointed district manager of the Chicago office of Chain Belt Co., Milwaukee. He joined Chain Belt in 1924 following graduation from Purdue university.

♦

Holo-Krome Screw Corp., Hartford, Conn., is starting construction of a 100 by 200-foot plant addition, the second in seven months.

♦

Manning, Maxwell & Moore Inc., Bridgeport, Conn., announces the change in name of its former Ashcroft American Gauge division to Ashcroft Gauge division, effective immediately.

♦

M. J. Tennes Jr. has been elected president of Shafer Bearing Corp., 35 East Wacker drive, Chicago. He has been vice president and sales manager for the past several years. A. H. Williams is now vice president and Ray P. Tennes, secretary and treasurer. They were formerly chief engineer and assistant secretary and treasurer, respectively.

♦

Expansion of its quarters in a new location at 1345 East Milwaukee avenue, Detroit, will permit the Micromatic Hone Corp. an approximate increase of 75 per cent in total number of employes and over 100 per cent in space occupied during the last eighteen months. The expansion, according to Kirke W. Connor, president, has resulted from normal growth and new developments.

♦

Increased floor space has been added to the Detroit plant of Joseph T. Ryerson & Son Inc., Chicago, to house part of the hot-rolled steel stock and to increase facilities for the company's reinforcing steel service.

♦

Address of the offices of Bakelite Corp. and Halowax Corp. was changed July 1 from 247 Park avenue to the Carbide & Carbon building, 30 East Forty-second street, New York.

♦

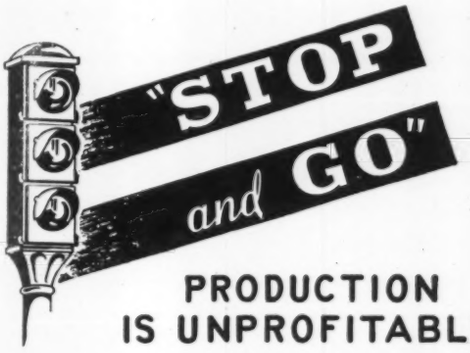
The Dayton Rogers Mfg. Co., Minneapolis, is expanding its plant by adding a one-story factory building, to house new machinery and other special equipment to be used in the manufacture of stampings in small lots. Present production will be almost doubled.

♦

Appointment of R. Volbrecht to the New York merchandising sales staff is announced by Cutler-Hammer Inc., Milwaukee. Mr. Volbrecht joined Cutler-Hammer after graduating from the University of Wisconsin and more recently was with the motor control sales division of the Philadelphia district office.

♦

Kennametal of Canada Ltd., with offices and factory at Hamilton, Ont., has been organized by George H. Alexander Machinery Ltd., Birmingham, England, in conjunction with Philip M. McKenna of McKenna Metals Co., Latrobe, Pa. Kennametal, the new carbide for hard inserts and cutting tools, will be manufactured for Canada and the British dominions. Mr. McKenna is president of the new firm and Arthur H. Alexander, Victoria, B. C., has been named general manager.



PRODUCTION IS UNPROFITABLE!

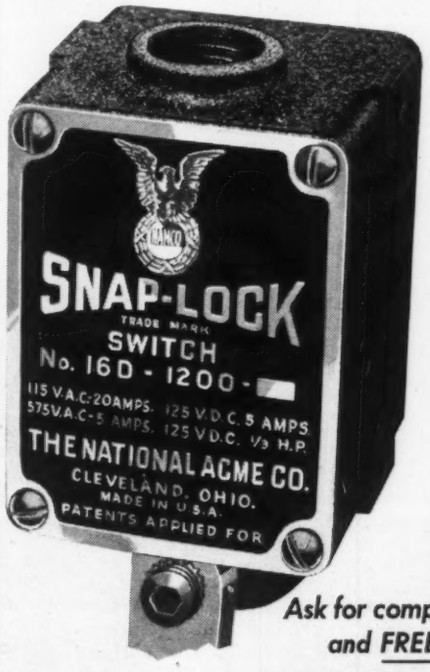
USE the Unisorb Machine Foundation and reduce your shutdowns, breakage, and repairs due to vibration or vibration transmission. Through research and actual working experience, Felters' engineers have proved the efficiency of Unisorb Machine Foundations in reducing vibration to a minimum in industrial plants. Unisorb Machine Foundations can be placed under new or old machines with equal ease.

Installation is simple, cost is low, and results are satisfactory.

Write today on your company letterhead for your copy of the booklet, "UNISORB IN THE INDUSTRIAL PLANT", which describes many different kinds of installations of machinery.

THE FELTERS COMPANY, Inc.
210 SOUTH ST., Dept. K-9 BOSTON, MASS.
Offices in Principal Cities

OVER 200 MFG'RS
have adopted THIS Limit Switch



—2 double break circuits.

—electrical and mechanical mechanism separately enclosed, positively insulated.

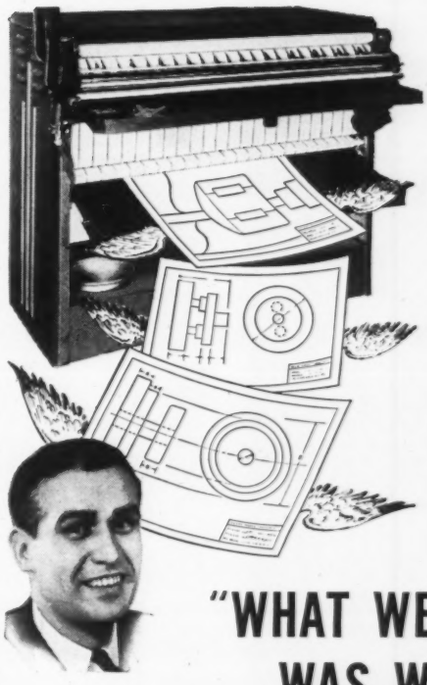
—operates on 10° travel, over-travel 29°.

—simple, compact, especially suited for heavy duty.

Ask for complete data and FREE TEST

"Give it the works"—at our risk

THE NATIONAL ACME CO. Cleveland, Ohio



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"WITH BUSINESS picking up, we simply couldn't keep abreast of orders by using old-fashioned blue prints.

"So we added wings to our print production—speeded it up substantially—by installing simple, compact equipment for making Bruning Black and White Prints!

"Now, with our Bruning Mercury "75" Printer and No. 154 BW developing machine, we get better, *black-line* prints much faster than with blue printing. There is no time-wasting washing and drying of prints, and no objectionable gases or vapors are used in developing.

"Incidentally, BW equipment has cut our electric current costs ⅔. And, by using BW sheets cut to the exact size of our tracings, we save the time, cost and waste of trimming."

* * *

Typical of the Bruning equipment which helps make such savings possible is this new Bruning Mercury "75" Printer. It operates at a speed of 20 feet per minute, with medium speed BW paper—uses only ⅓ the current of a much more expensive carbon arc machine of equal capacity. Its new type Hanovia mercury vapor quartz lamp has a guaranteed lamp life of 1000 hours! Mail the coupon for free booklet!

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Please send me your free booklet—"New Light on Prints."

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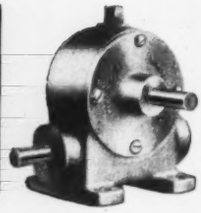
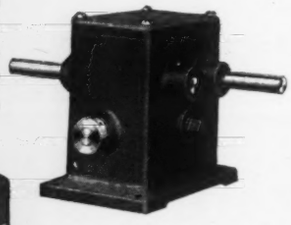
THE SIZE AND TYPE OF
SPEED REDUCER
YOU WANT... AT THE
PRICE YOU WANT TO PAY

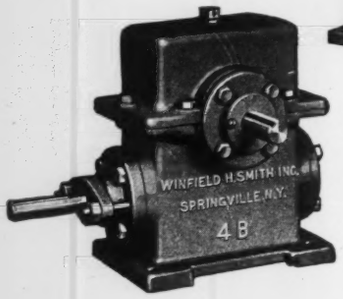


MANY SIZES CONSTANTLY IN STOCK

At right is one of a big variety of double reduction worm gear reducers (anti-friction bearing type). 40 to 7000 inch pounds torque. 25-1 to 3850-1 ratio.

Fractional horse-power worm gear reducers for continuous and intermittent duty.





At left is popular number among single reduction worm gear reducers (anti-friction bearing type). 1/20 HP to 7½ HP. 6-1 to 132-1 ratio.

WHS expert engineering service, no obligation. Have you latest catalog No. 140? Write for it.

WINFIELD H. SMITH, Inc.
A Speed Reducer for Every Application
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Rapidly growing U. S. industrial expansion with its greatly increased output calls for "counters" and modern reset registers for all production machines designed integral with machines. Write for complete information about Durant PRODUCTIMETERS THE SPEEDOMETERS OF INDUSTRY for all industrial counting problems.

ASK FOR CATALOG SECTION No. 10

DURANT MANUFACTURING CO.
1933 N. Buffum Street, Milwaukee, Wisconsin

NEW MACHINES—
And the Companies Behind Them

(For illustrations of other outstanding machinery see Pages 56-57)

Aircraft
Radial aircraft engine, Wright Aeronautical Corp., Paterson, N. J.

Confectionery
Counter freezer, Larac Co., Chicago.

Domestic
*Radio, Emerson Radio & Phonograph Corp., New York

Dry Cleaning
Solvent reclaiming unit, Detroit Rex Products Co., Detroit.

Engraving
Gold stamping machine, H. O. Bates, Elizabeth, N. J.

Finishing
Superfinish machine, Ohio Units, Dayton, O.
Automatic composition applicator, Packer Machine Co., Meriden, Conn.
Buffing machine, Hisey-Wolf Machine Co., Cincinnati.

Flour Mill
Feed dresser, Forster Mfg. Co., Wichita, Kans.
Hammermill, Dixie Machinery Mfg. Co., St. Louis.
Scale, Exact Weight Scale Co., Columbus, O.

Food
Horizontal plate filter, Sparker Mfg. Co., Chicago.
Flake ice machine, York Ice Machinery Co., York, Pa.
Liquid mixer, Miller Hydro Co., Bainbridge, Ga.

Glass
Horizontal batch mixer, Prater Pulverizer Co., Chicago.
Glass cutting and flare forming machine, Eisler Engineering Co., Newark, N. J.

Industrial
Dust collector, American Foundry Equipment Co., Mishawaka, Ind.
Machine for setting nuts, Fabri Steel Products Inc., Detroit.
Vacuum cleaner, Ideal Commutator Dresser Co., Sycamore, Ill.

Laboratory
Self-contained hot plate press, Baldwin-Southwark Division, Philadelphia.

Lubricating
Stationary industrial delivery foot gun, Alemite Div., Stewart-Warner Corp., Chicago.

Maintenance
Single bucket scraper, R. G. Le Tourneau Inc., Peoria, Ill.

Marine
Speed reducer winch, Stephens-Adamson Mfg. Co., Aurora, Ill.

Materials Handling
Lift truck, Towmotor Co., Cleveland.
Lifter for dies, etc., Economy Engineering Co., Chicago.
Tilting box grab, Cleveland Tramrail Div., Cleveland Crane & Engrg. Co., Wickliffe, O.

Metalworking
Contour milling machine, Snyder Tool & Engineering Co., Detroit.
Hydraulic press, Lake Erie Engineering Corp., Buffalo, N. Y.
Knee-type hydraulic press, Denison Engineering Co., Columbus, O.
Metal band saw, Grob Bros., Grafton, Wis.
Portable air grinder, Independent Pneumatic Tool Co., Chicago.
Twin broaching machine, The Oilgear Co., Milwaukee.
Vertical milling machine, Midway Machine Co., St. Paul.
Cabinet lathe, Rivett Lathe & Grinder Inc., Brighton, Boston.
Hydraulic press for aircraft parts, Farrel Birmingham Co. Inc., Ansonia, Conn.
*Combination vertical milling machine and borer, Machinery Mfg. Co., Los Angeles, Calif.
*Bench type grinder, H. P. Preis Engraving Machine Co., Newark, N. J.
*Plain milling machine, Brown & Sharpe Mfg. Co., Providence, R. I.

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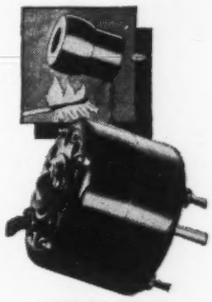
WITH VICTOR MOTORS!

Motor-wise engineers know that well-built shaded-pole induction type motors can take punishment in large doses. The wisest of these motor-wise know that VICTOR MOTORS are the toughest, coolest-running members of this rugged family. It is not just an accident that Victor Motors run cooler, last longer. We designed them that way — more current is converted into power, less into heat. Properly insulated coils — Victor flash test at 1000 Volts — special oversized oil impregnated self-lubricating bearings — are just a few of the reasons every Victor Motor is good for years of use and abuse. 1/200 to 1/10 H. P. Write today for illustrated literature.



MODEL M-36
1/50 H. P.

VICTOR ELECTRIC PRODUCTS, Inc.

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SURFACE GRINDER DUST COLLECTOR

For Your Grinder of Whatever Make or other Dust Creating Device.

A Complete Motor-Driven Unit at Small Cost

This small, yet powerful, machine occupies but 11" x 13" space. It consists of a sturdy, powerful suction blower, electrically driven, with piping connections to the surface grinder and to the high grade dust disposal bag.

It can easily be placed on the floor or a shelf on a nearby pillar or wall, out of the way. It can be plugged into any lamp socket.

The strong suction of air draws away all the light metallic and light abrasive dust created when grinding. This highly irritating dust is caught in a bag made of specially treated filter cloth which may be quickly emptied when necessary.

Don't Breathe Grinding Dust!

"The direct cause of silicosis is the inhalation of minute particles of silica dust. While the type of pulmonary lesion depends on the particular dust inhaled, the underlying pathological principle is the same in all forms of the disease, viz., an ultimate fibrosis and replacement of the elastic lung tissue by a hard unyielding fibrous tissue."

SILICOSIS IS INCURABLE!

GET FREE INFORMATION AND FOLDER No. PIJ ABOUT THE DANGERS OF DUST

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MAKERS OF GOOD MACHINERY FOR 50 YEARS

In October

DIRECTORY OF MATERIALS

(EIGHTH EDITION)

WATCH FOR IT!

MACHINE DESIGN's editorial staff has brought all listings up-to-date and a new section covering Producers of Machine Finishes is being included this year.

Users will find extensive information on:

1—Alloys, Ferrous and Nonferrous, by Tradenames.
2—Plastics and Nonmetallic Materials, by Tradenames.
3—Producers of Tradenamed Materials.
4—Stampings Producers.
5—Forgings Producers.
6—Die Castings Manufacturers.
7—Plastics Molders.
8—Producers of Machine Finishes.

As in previous issues, the Directory will be bound separately as a unit and then stitched in the center of the magazine proper. This arrangement provides a removable filable supplement and ready reference guide. Advertising pages in the Directory will give readers additional data. Extra copies will be available at 25c each. Address

MACHINE DESIGN

Penton Building Cleveland, Ohio

Hydraulic straightening press, Lake Erie Engineering Corp., Buffalo, N. Y.

Mining

Hydraulic braking system, Jeffrey Mfg. Co., Columbus, O.
Vibrating screen, Robins Conveying Belt Co., Passaic, N. J.
Portable placer machine, Universal Dredge Mfg. Co., Denver, Colo.
Two-wheel hydraulic scraper, Bucyrus-Erie Co., South Milwaukee, Wis.

Office

Mechanical check writer, The Todd Co. Inc., Rochester, N. Y.

Packaging

Weighing unit, Weigh Right Automatic Scale Co., Joliet, Ill.
Cigarette wrapping machine, Package Machinery Co., Springfield, Mass.
Vacuum sealing machine, White Cap Co., New York.
Hoop making machine, The Federal Machine & Welder Co., Warren, O.

Paper

Flow box and combination slice machine, Pusey & Jones Corp., Wilmington, Del.

Pharmaceutical

Rotary tablet machine, Arthur Colton Co., Detroit.

Plastics

Machine for insulating wire with plastics, John J. Royle & Sons, Paterson, N. J.
Molding press, Hannifin Mfg. Co., Chicago.

Pressing

Trouser shaper, Huebsch Mfg. Co., Milwaukee.
Sleeve finisher, W. M. Cissell Mfg. Co., Louisville, Ky.

Printing

Composing room saw, American Type Founders Sales Corp., Elizabeth, N. J.
Web offset newspaper press, American Type Founders Sales Corp., Elizabeth, N. J.

*Illustrated in pictorial center spread, Pages 56-57.

Vertical press, Miehle Printing Press & Mfg. Co., Chicago.
Flat vacuum casting box, Goss Printing Press Co., Chicago.

Processing

Furnaces, Pyrolectric Co., Trenton, N. J.
Tempering and drawing furnace, Despatch Oven Co., Minneapolis.

Quarry

Crusher, Iowa Mfg. Co., Cedar Rapids, Ia.
Heavy-duty crawler crane, Lima Locomotive Works, Lima, O.
Crusher, Eagle Crusher Co., Galion, O.
Shovel dragline crane, Link Belt Speeder Corp., Chicago.
Diesel tractor, Allis-Chalmers Mfg. Co., Milwaukee.
Crusher, Traylor Engineering & Mfg. Co., Allentown, Pa.

Refining

*Earth drill, The Buda Co., Harvey, Ill.

Rubber

*Bale cutter, Farrel-Birmingham Co. Inc., Ansonia, Conn.
Semiautomatic tire building machine, National Rubber Machinery Co., Akron, O.
Power driven dip machine, Miami Boiler & Machine Co., Akron, O.
Four-press rubber molding machine, French Oil Machinery Co., Piqua, O.
Rubber mills, Stewart-Bolling & Co., Cleveland.
Dispersion machine, Promulsor Corp., New York.
Molding and preforming presses, Ferriot Bros. Inc., Akron, O.
Laboratory presses, F. J. Stokes Machine Co., Philadelphia.
Tire machine, National Rubber Machinery Co., Akron, O.

Textile

*Dyeing machine, Rodney Hunt Machine Co., Orange, Mass.

Welding

*Spot welders, American Fusion Corp., Chicago.
*Welder, Progressive Welder Co., Detroit.
High-speed spot welder, The Eisler Engineering Co., Newark, N. J.
Multiple coil welder, Bear Mfg. Co., Rock Island, Ill.
Arc welder, General Electric Co., Schenectady, N. Y.

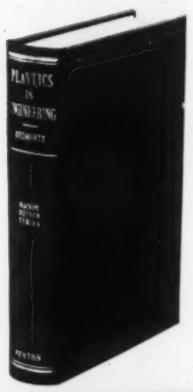
PLASTICS IN ENGINEERING

FOR the first time the subject of plastics in engineering is completely covered and discussed in an authentic volume, written by J. Delmonte, recognized authority on the practical use and application of plastics.

This book, numbering 620 pages, is profusely illustrated and covers the field of plastics from their chemical and physical make-up to their applications under all sorts of industrial conditions.

Included are full considerations and discussions of designing, applying and producing organic plastics, laminated plastics, synthetic rubbers and finishes . . . with convenient indexing that permits ready reference. "Plastics in Engineering" is available for immediate shipment and can be supplied by the publishers either on ten days' free trial examination, or C. O. D. Its price is $7.50.

MACHINE DESIGN . . . Book Department . . . 1213 West Third St., Cleveland, O.



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Power with NOVO

There are secrets to success in building concrete mixers and Ransome Concrete Machinery Company have found that the power unit is a big factor. They use Novo Model AC, 2 HP, heavy-duty engines for their 3½-S Model U Mixer—the latest development in a long line of famous mixers.

Novos have heavy-duty crankshafts and flywheels. They are roller and ball bearing equipped and have extra large cooling, gasoline, and oil capacities.

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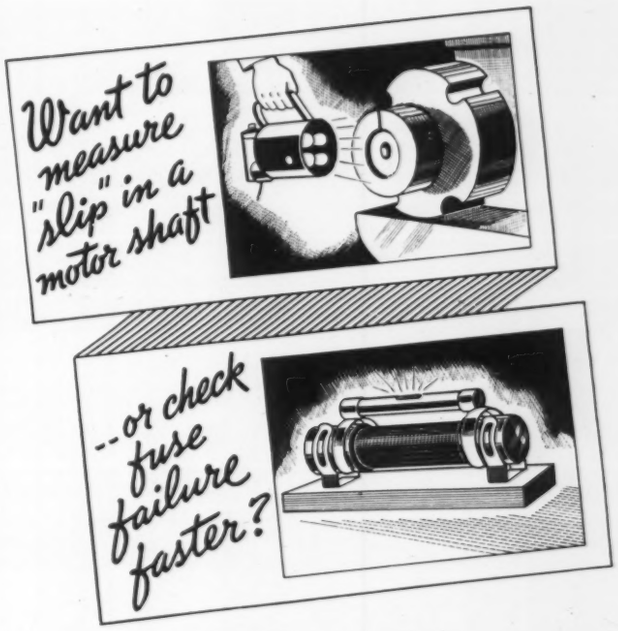
AVAILABLE: Development Engineer. Graduate engineer (1929)—Six years on drafting board, three years mechanical development and research, two years executive experience. Top-notch machine designer. Steel mill and machine tool experience. Now employed but able to handle a bigger job. Address Box 132, MACHINE DESIGN, Penton Bldg., Cleveland, Ohio.



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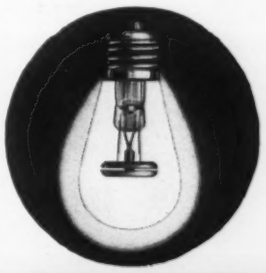
GENERAL ELECTRIC Neon Glow Lamps have unique characteristics that make them readily adaptable to a wide variety of uses in industry, the laboratory, and the home. They are rugged, long-lived, low current lamps that are extremely dependable.

Glow lamps operate for a useful life of 3000 hours and withstand both shock and vibration to an unusual degree. Useful life is usually ended by eventual bulb blackening . . . rather than by failure of light source. Thus the user may determine the useful life when he wishes to do so, rather than experience a lamp failure at some undetermined time.

Industrial plants use them continuously for pilot lights and indicators. They may also be used on various types of electrical equipment for similar purposes. Tear out and mail the coupon below for a handy folder suggesting some of their multitude of uses.



G.E. Neon Glow lamps are made in sizes from ¼ to 3 watts for operation at standard voltages on both D.C. and A.C. They come provided with bases to fit standard sockets and require no accessory devices. Your wholesaler or jobber can supply you.

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